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Managing Editor: HUGH S. POCOCK, M.I.E.E. *Technical Editor:* W. O. FENWICK, M.I.E.E.
Industrial Editor: J. H. COSENS *Technical Consultant:* C. O. BRETTELLE, M.I.E.E.

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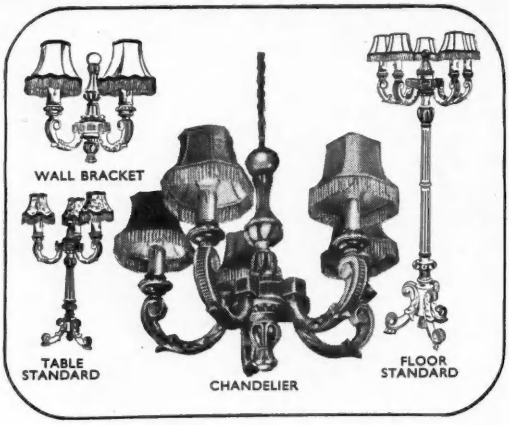

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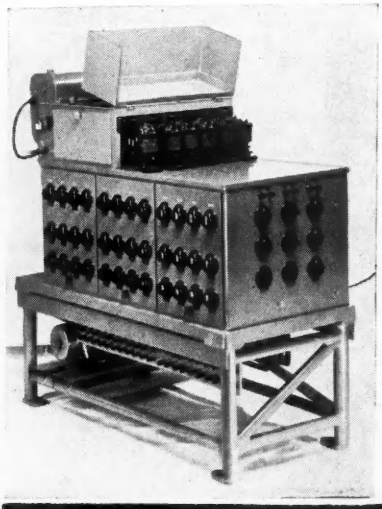

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ELECTRICAL REVIEW

Vol. CXLIX No. 3858 2ND NOVEMBER, 1951

THE OLDEST ELECTRICAL PAPER • ESTABLISHED 1872

New Brooms

INDUSTRY AND THE CHANGE OF GOVERNMENT

BEFORE the General Election we stressed our constant endeavour to keep away from party politics. We still adhere to this course but feel bound to comment on the change which was brought about last week and to express the hope that the change will mean an improvement so far as the electrical industry is concerned.

First we must acknowledge that any Government must be influenced in its policy by world economic conditions and the actions of other nations which are largely beyond its control. It is unlikely then that a change of Government will mean immediate relief from the disabilities under which this country suffers. There are, however, some internal strains which it is possible to relieve, or at least distribute more evenly.

Electricity and Production

We have already said that interference with the electricity supply industry for purely political considerations should be avoided and that any attempt to de-nationalize it would be calamitous. It may be possible to improve the organization but any root-and-branch reconstruction is out of the question. The new Government must regard electricity supply as the key to higher industrial output and create the conditions which will ensure that new generating plant is brought into operation as speedily as possible. It must also recognize that distribution is important too; so-called economies in this direction may prove costly in the end.

The idea that electricity in the home is a luxury must be abandoned and the penal purchase tax on certain electrical appliances—immersion heaters, vacuum cleaners and refrigerators particularly—should be reduced or removed.

Steel Output

Adequate steel at a reasonable price is important to the electrical industry. It is very doubtful whether a nationalized iron and steel industry will meet the requirements. Here is an example of a basic manufacturing industry, already subject to sufficient control, being taken over at a time when increased efficiency and output were essential. The adverse effects of nationalization have not yet been fully felt because the general structure of the industry remains much as it was. This retention of the individual units makes de-nationalization comparatively simple.

One other matter which perhaps

would have affected the still-expanding electrical industry as much as most was the proposed limitation of dividends. It can be presumed that this ill-conceived project is now dead. As a " gesture " it was futile and it could not have been applied fairly.

We have expressed our hopes but there are also some fears. Ultimately the people's welfare rests with themselves, not their Government. Unless there is a realization that salvation lies only in sustained endeavour any Government is powerless. Let us hope that this fact is appreciated.

PEAK LOADS

The idea that the domestic load is largely responsible for peak difficulties was rebutted by Mr. A. H. Young in his chairman's address to the I.E.E. Utilization Section last week. This view often arises from a misconception of the economic dependence of the electricity supply on diversity factor. The interweaving of the supply to factory motors (with a load factor of only 20 to 25 per cent) with that to residences is largely the cause of the system load factor reaching 46 per cent, thus ensuring the best use of high-cost plant. His suggestion that the electrical space heating problem should not be solved by restrictions but by the development of low-wattage appliances as a long-term measure seems to us the soundest approach.

POWER CUT WARNINGS

Now that details have been announced of the load-shedding warning agreement between the B.B.C. and the British Electricity Authority it can be seen how closely the system resembles that advocated in our leading article of 21st September. It will be necessary for factories to have a receiver permanently tuned in to the long-wave Light Programme. Attention will be drawn to the imminence of an announcement by the transmission of the familiar continuous tuning note and then will follow particulars of the area in which load is about to be " shed " and of the amount of shedding, indicated by numbers (5 per cent steps). We would have preferred more localized warnings, for the system adopted means listening to every announcement whether applicable to the individual works or not. Nevertheless industrialists will welcome the opportunity given to prepare for " cuts " and we thank the B.B.C. and B.E.A. on their behalf. The South West Scotland Electricity Board is instituting a scheme of its own by which short-wave radio warnings will be given to industrialists. If necessary the Board will provide receivers gratis.

STUDENT EXCHANGES

The brief reference on another page to the fourth annual report of the International Association for the Exchange of Students for Technical Experience records continued good expansion of the project. The Association is maintaining its policy of complete independence; it is not affiliated to, or connected with, any other organization. The report is published with the financial assistance of U.N.E.S.C.O. Progress is satisfactory although, when reviewed internationally, there is an insufficiency of places in some countries to satisfy the needs of all students wishing to gain experience abroad. This is a point to be kept in mind by industrial and commercial organizations intending to receive I.A.E.S.T.E. students next summer.

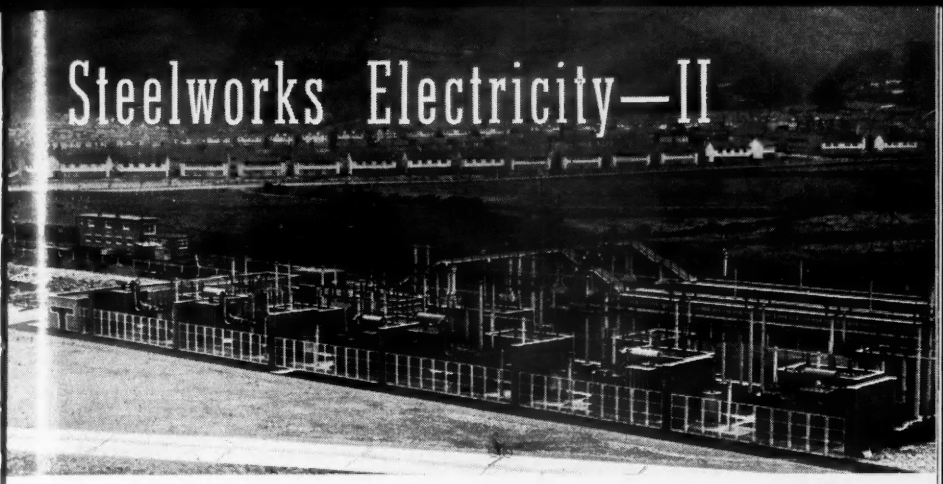
CONSULTING ENGINEERS

The latest annual report on the activities of the Association of Consulting Engineers, which is briefly referred to on another page, records a satisfactory inflow of new members. When, however, regard is had for the wastage due to deaths, retirements, etc., which is normally appreciable, the net influx may not be quite so good as it looks. If the A.C.E. is to ensure that it will continue to be truly representative of its section of the engineering profession, it will need to include a majority, if not quite all, of those who fulfil the Association's qualifications for membership.

WORK IN CANADA

Informed opinion about the excellent Lowe report, which has been in circulation for a year, seems to agree that the time is ripe, in view of the assistance proffered by the Board of Trade and the Export Credit Guarantee Department, for firms of consulting engineers desiring work in Canada to consider establishing offices in the Dominion. Such action could, in time, be of much value, for the long view appears to suggest that engineering constructional works involving large expenditure at home may, for various reasons, be decreasing.

Steelworks Electricity—II



Distribution System at the New Works in South Wales

As was mentioned in the first part of this article (26th October issue), although the Abbey, Margam and Port Talbot establishments are regarded as three separate major works sections, they are served by one electrical distribution scheme. Both the main distribution at 11 kV and the secondary system at 3·3 kV are arranged geographically and electrically to provide for flexible and reliable intakes of power.

There are two distinct sources of supply to the works, the bulk of which is obtained from the grid and, as already explained, the remainder from the company's power station at Margam. Five independent supplies are taken from the grid. Two are afforded by 40,000 kVA 66 kV overhead lines from Llynfi power station, and one is by a 66 kV overhead line of 40,000 kVA capacity from Pyle substation. These supply points on the South Wales Electricity Board's system are interconnected to ensure continuity of supply. The other 66 kV supply is taken from the S.W.E.B. system at Bryn, about five miles north-east of the works and situated on the mountainside. This supply is controlled by a Fuller Electrical 66 kV oil-minimum circuit breaker and transformed to 11 kV at Bryn by an English Electric 6,000 kVA 66/11 kV star/star connected type ON outdoor on-load tap-changing transformer, and is then transmitted at 11 kV by a double circuit overhead line to the Margam works section.

The remaining supply is taken again from Pyle substation at 33 kV and is transformed by a 10,000 kVA Johnson & Phillips star/star connected type ON outdoor transformer to 11 kV and connected to the works by a seven mile double circuit overhead line. This supply is chiefly used for supplying through a Reyrolle 150 MVA, four-panel horizontal draw-out oil circuit breaker switchboard, the company's limestone quarries at Cornelly and a number of N.C.B. collieries; it finally ends up as a single circuit line connected to the Abbey works section pump house substation. This supply is normally held as a standby at the pump house, but it is also used as an alternative supply to the quarries and collieries whenever necessary.

At Cefn Gwrgan is the main substation in the works distribution system. It has a total installed transformer capacity of 82,500 kVA made up as follows: three English Electric 17,500 kVA 66/11 kV star/star connected type ON, on-load, tap-changing transformers supplying the rolling mill main drives; and three English Electric 10,000 kVA 66/11 kV star/star connected type ON, on-load, tap-changing transformers supplying works base loads. The on-load tap-changing equipment is arranged

Above: **The 82,500 kVA Cefn Gwrgan substation is the main substation in the works distribution system**

in thirteen steps from plus 5 per cent to minus 15 per cent of the higher voltage. The neutral points of the 11 kV windings are connected to earth through liquid resistances which limit the earth fault current to twice the full load current of its transformer.

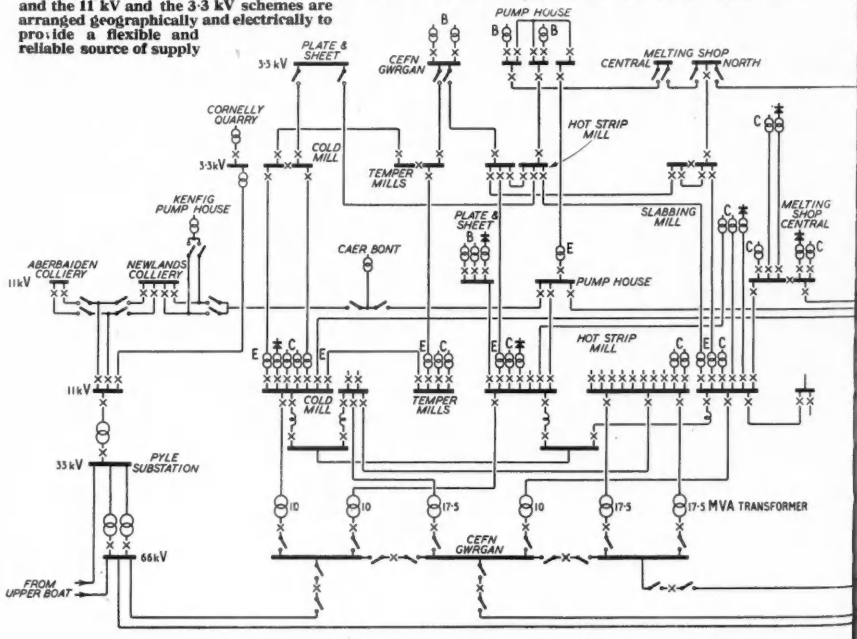
All the switchgear in the substation is English Electric 66 kV air blast equipment of 1,500 MVA rupturing capacity, working from a fully duplicated 250 lb/sq in compressed air supply system. There are eleven circuit breakers, housed in separate brick constructed blockhouses. The protective and metering current transformers are mounted in the roof bushings.

The substation control room for accommodating the control and metering equipment and protective gear is near the open compound. The control panel for each breaker is fitted with a three-position selector switch, allowing control from the central control room, the substation control room, or locally. The control room at the main works is described below; local control consists of a panel mounted in the circuit breaker blockhouse and adequately subdivided. The compressed air equipment is housed in a room next to the control room, and a further compartment is provided for the distribution switchgear supplying the substation auxiliaries.

The main distribution system is at 11 kV three-phase, three-wire, 50 c/s, with the neutral earthed. The principal distribution centres for the Abbey works section are at the strip mill and cold mill substations where Reyrolle 250 MVA, 350 MVA and 500 MVA solenoid operated, horizontal draw-out oil circuit breaker switchboards with compound filled busbars are installed. The switchboards are arranged in five sections which may be connected together by means of two star busbar 350 MVA reactor switchboards.

Owing to the heavy concentration of power at the busbars for supplying the rolling mill loads, 500 MVA switchgear had to be installed. There are two of these switchboards which supply the peak rolling loads either direct (roughing mill), through mercury arc rectifiers (finishing mill) or

All the major works sections are served by one electrical distribution system with thirty-five h.v. substations and the 11 kV and the 3·3 kV schemes are arranged geographically and electrically to provide a flexible and reliable source of supply



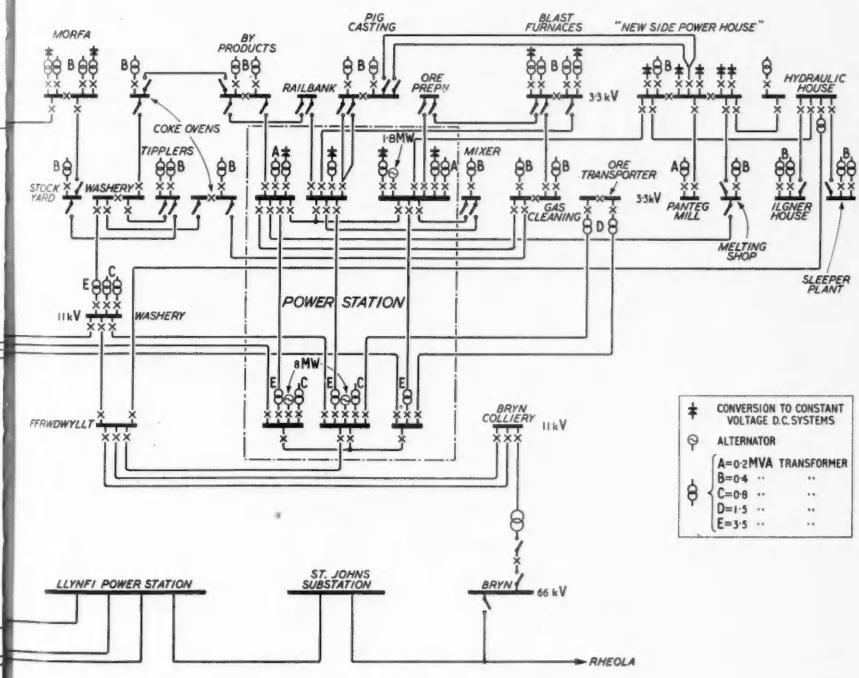
through synchronous motor generators (cold mill). The peak rolling loads are estimated to be approximately 100,000 kW.

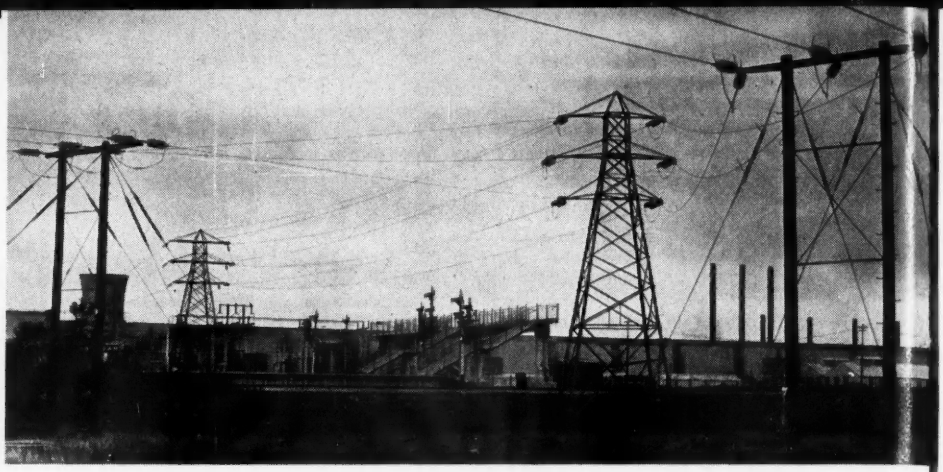
The remaining three switchboards are coupled together through reactors as shown in the diagram, thus enabling switchgear of only 250 MVA capacity to be used for supplying the works base loads. Although provision is made for connecting the 500 MVA and 250 MVA systems together, they will normally be operated separately, apart from their being in parallel at 66 kV. Situated near the strip mill substation is the main works control room, which is used for the remote control of all incoming supplies at Cefn Gwrgan substation, control of the strip mill, slabbing mill, pump house and plate and sheet substations; the control engineer at the cold mill has remote control over the cold mill and temper mill substations. Control in all cases is effected through pilot cables.

The main distribution centre for the Margam and Port Talbot works sections is at the power station. The Allen West 11 kV 250 MVA solenoid operated, vertical isolation, circuit breaker boards are arranged in three sections, each of which has or will have a G.E.C.-Fraser & Chalmers 8,000 kW turbo-alternator connected to it. The three sections of switchgear are interconnected with cable on the "star-busbar" principle and thence interconnected with the main 11 kV system.

It has been arranged that in the event of a failure of all incoming supplies to the works, the alternators in the power station will continue to supply all vital loads throughout the works, means for automatic disconnection of all non-vital loads having been provided at strategic points on the system. Automatic voltage regulators, normally inoperative, have been fitted to the alternators, but in the event of the latter having to run isolated, the regulators would immediately take control, thereby governing the system voltage.

The major part of the secondary distribution system is at 3·3 kV, three-phase, three-wire, 50 c/s, with the neutral unearthed. The 3·3 kV system is supplied direct from the 11 kV system via Johnson &





Two of the works incoming supplies are by 40,000 kVA 66 kV lines from Llynfi power station

Phillips 3,500 kVA 11/3·4 kV (no load) delta/delta connected outdoor type ON transformers, and also by two G.E.C.-Fraser & Chalmers 1,800 kW turbo-alternators installed at the Margam power station. The system is arranged to operate in sections so that the required short circuit capacity of the switchgear does not exceed 75 MVA. The system is very flexibly interconnected so as to provide reliable stand-by supplies to the blast furnaces, coke ovens, pump houses, melting shops and by-product plants.

Motors ranging from 100 h.p. to 2,000 h.p., and also a 3,500 h.p. motor generator set driving motor associated with the reversing mill at the Port Talbot works section are supplied from the system. In most cases the oil circuit breakers are used for direct switching of the machines. These switches are usually of the solenoid operated type and arranged for remote control. The 3·3 kV switchgear at both the Abbey pump house substation and Margam power station is again in three sections and interconnected with cable on the " star-busbar " principle. This is necessary owing to the vital pumping plant and other important auxiliaries which are supplied from these centres.

A smaller part of the secondary distribution system is at 3·3 kV, three-phase, three-wire, 50 c/s, with the neutral earthed. It has been necessary to adopt the earthed neutral system at both Cornelly Quarries and the ore handling plant at the Margam works section. The ore-transporter substation at Margam is supplied direct at 11 kV from the power station and is then transformed by two Ferranti 1,500 kVA 11/3·4 kV delta/star outdoor type ON transformers. The neutrals of the 3·4 kV windings are connected directly to earth. These transformers supply two sections of Reyrolle 75 MVA manually operated horizontal draw-out oil circuit breaker switchboards with a busbar section switch.

Supplies are taken from the outgoing feeder switches by 3·3 kV trailing cables in a deep walled open trench to the ore transporters. These cables are coiled on a motor operated drum and are connected to Reyrolle 75 MVA motor operated pillar type switchgear in the pier legs of the transporters. This supply is conveyed to the transporter man trolley by means of live conductor rails with pickups for operation of the main m.g. set driving motor. Sensitive earth leakage protection is provided. The major portion of the switchgear for the new developments has been provided by Metropolitan-Vickers and is of the metalclad horizontal draw-out pattern with air insulated and taped busbars. A large number of non-automatic oil immersed hand operated isolators capable of breaking their rated full load current have also been supplied for inclusion in the various switchboards.

The medium and low pressure a.c. system is 415/240 V, three-phase, four-wire, 50 c/s. This system is supplied from Brush 800 kVA 11 kV/431 V (no load) star/star connected type ON outdoor transformers

and G.E.C. 400 kVA 3,300/431 V star/star connected type ON outdoor transformers. Again, by suitable sectioning, the prospective short circuit energy does not exceed 25 MVA. The neutral points of the 431 V windings of these transformers are connected direct to earth. Motors below 100 h.p. and the general works lighting are supplied from this system, which is again adequately interconnected to provide standby supplies.

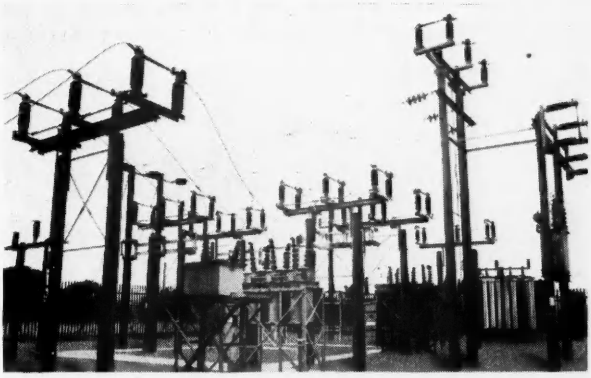
There are two distinct types of switchgear used for duty on this system. In most substations there are Crompton Parkinson 25 MVA manually operated, vertical isolation, oil circuit breaker switchboards, the other type being English Electric 25 MVA air break switches mounted on open slate panels. To save space the latter have been erected, where necessary, back to back.

The d.c. system of 440 V, two-wire was chosen for the new works section at Abbey when considering the large area to be served and the long feeders and crane conductors. The schematic diagram shows that there are six supply points. If necessary, the whole system can be solidly interconnected.

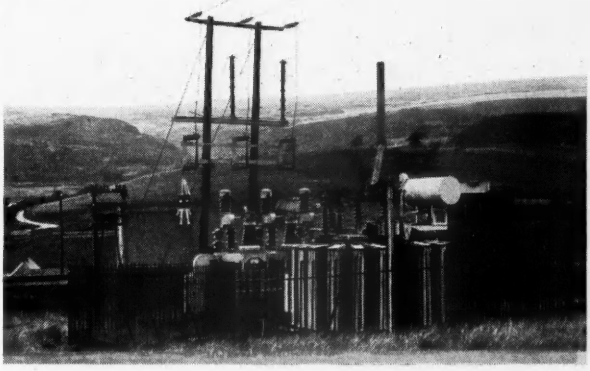
The six substations are equipped with G.E.C. 1,600 kW four-cylinder, 12-phase, steel tank pumpless type mercury arc rectifier banks supplied from the 11 kV system. The main rectifier transformer is delta connected on the primary side with split end windings. This enables pairs of equipments to operate as equivalent 24-phase units. The l.v. side of each unit is a 12-phase quadruple zig-zag connection with three interphase transformers for load sharing. Each unit is fitted with anode fuses designed to operate instantaneously at approximately fifteen times full load current.

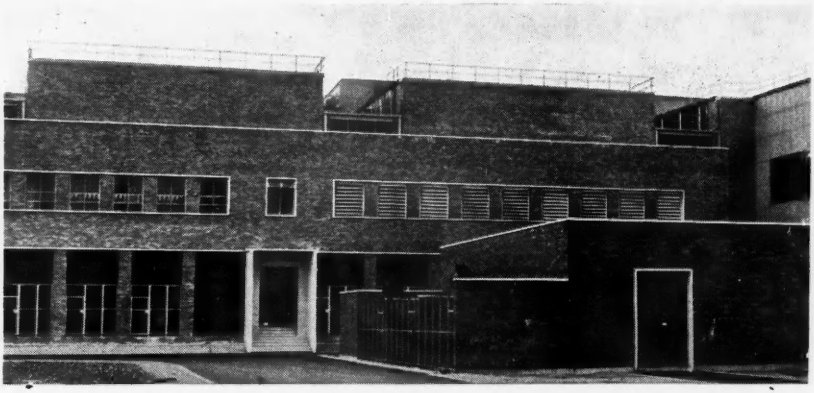
No d.c. circuit breakers are provided. To prevent the inherent rise in voltage at low loads a loading resistance is automatically connected across the bars to provide an artificial load. The necessary equipment for regeneration is supplied for each substation and allows in each case for approximately 50 kW of regenerated power for one minute continuously, with a maximum of three minutes in every ten in order to meet the worst conditions likely to be experienced.

To assist in the clearance of "earth



A 33 kV supply is taken at Pyle public supply substation: left to right, 33 kV incoming, circuit breaker, 33/11 kV transformer. *Below:* **One 66 kV works incoming line runs from Bryn, five miles north-east of the works on the mountainside**





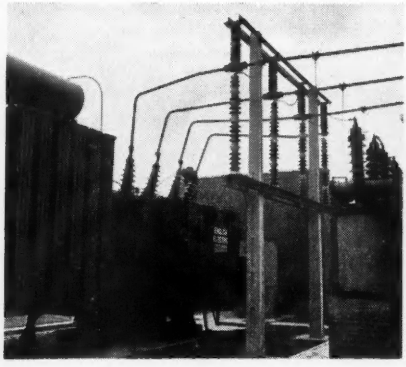
One of the principal distribution centres for the Abbey Works section is the strip mill substation shown on the right; strip mill control room, left and behind substation; one transformer cubicle open

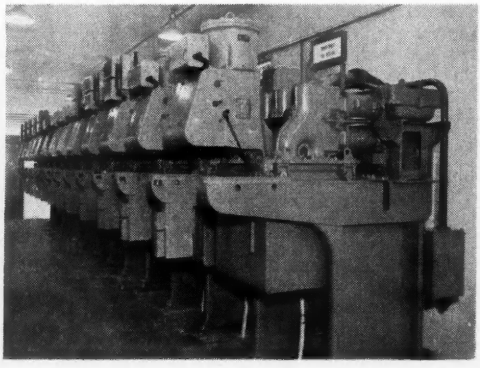
faults " a fault throwing device is provided for three substations and each is arranged so that (1) under normal conditions the mid-point of the system is tied lightly to earth by a potentiometer passing only a small current; (2) on the occurrence of an earth fault on one pole the opposite pole would be connected to earth through a resistance designed to pass up to approximately 75 A; (3) By means of a paralleling switch, the above current could be increased up to approximately 140 A if and when desired. Any of the three equipments can be selected as the " master."

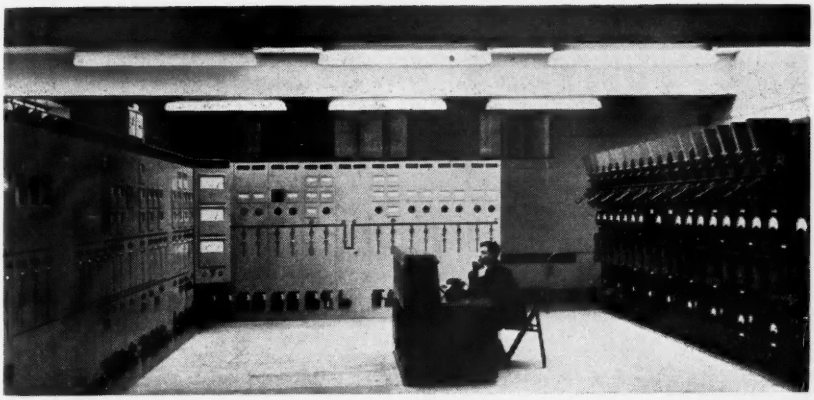
If the earth fault is not cleared within ten seconds an alarm is given at the central control room. In order to help determine the faulty circuit each switchboard is equipped with a saturable reactor d.c. earth leakage equipment. This comprises a ring-type current transformer, the secondary of which is connected to a milliammeter graduated in amperes. Scale deflection is proportional to fault current.

In cases where d.c. supplies are required at points too remote to be included in the main system, Nevelin glass bulb rectifiers have been installed. At the Morfa substation, which supplies chiefly the central repair shop and is situated between the

Left: **Three 10,000 kVA 66/11 kV star/star transformers (one shown) at Cefn Gwrgan serve for base loads; potential transformer right.** *Right:* **In the main distribution centres 250 MVA, 350 MVA and 500 MVA (shown) horizontal draw-out 11 kV circuit breaker switchboards are employed**







The control engineer at the cold mill has remote control over the cold mill and temper mill substations

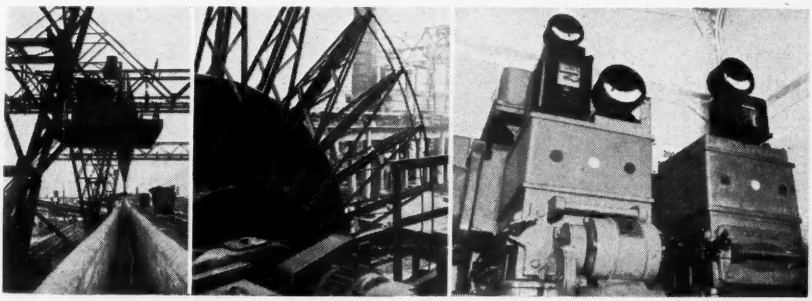
Abbey and Margam works sections, a 200 kW 440 V six-phase glass bulb rectifier supplied from the 3·3 kV system has been installed. At the blast furnaces in the Margam works two 300 kW 220 V glass bulb rectifiers are employed for supplying ore unloading and blast furnace auxiliaries. This system has one pole earthed in order to supply the ore transfer cars by the " third rail " method. In order to transfer regenerated power to the mains a grid controlled invertor bulb is included in each equipment.

At the Margam power station three Siemens 500 kW and one G.E.C. 1,000 kW rotary convertors supplied from the 3·3 kV system are in commission and were the original means of supplying the 220 V system at the Margam melting shop. They are still retained for this purpose. At the Port Talbot works section the 440 V system is supplied by two Bruce Peebles 750 kW m.g. sets and a Crompton 500 kW m.g. set. The 220 V system is also supplied by two Bruce Peebles 750 kW sets. All machines are supplied direct from the 3·3 kV system.

The main distribution cable network is of exceptional size and the problem of dealing with such large numbers of cables has been met by the construction of underground cable tunnels in the foundations of the main buildings, interconnected where necessary. The cables are supported throughout the entire length of the tunnels on perforated steel trays resting on steel inserts built into the sides of the tunnels. It is estimated that British Insulated Callender's Cables have supplied and laid over 350 miles of main cable.

A feature of this part of the work is the

3·3 kV trailing cables to the ore transporters, in a deep walled open trench, from which they are coiled on a motor-operated drum; they are connected to 75 MVA motor operated switchgear in a cabin in the pier legs of the transporter

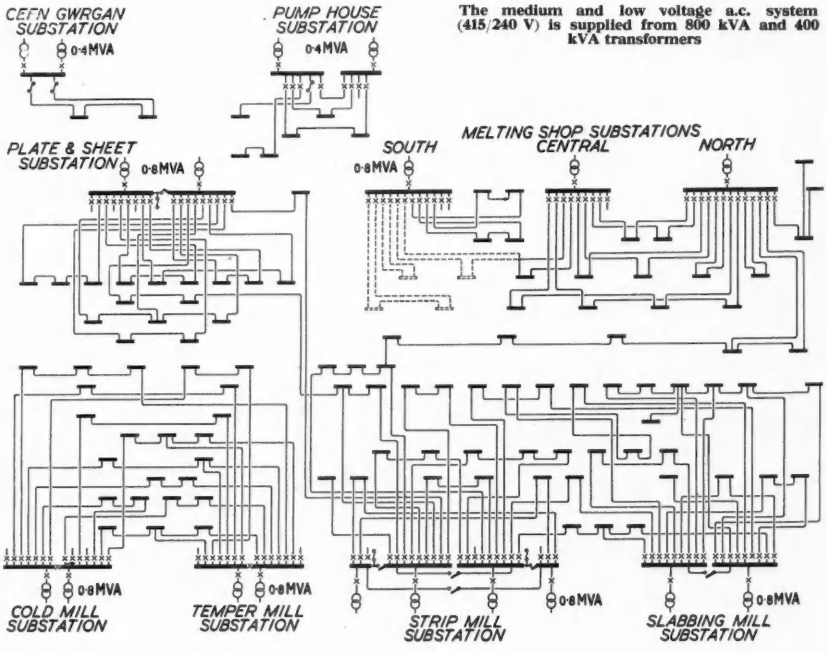


cable tunnel connecting Cefn Gwrgan substation with the strip mill substation, which has eight " trefoil " runs of 11 kV 0·5 sq in cables and is 450 yd long. The " trefoil " cleats are of the silicon aluminium type. As these cables are of vital importance the tunnel has a dividing wall running the whole length, with selected cable runs in each section, to reduce the risk of fire or physical damage to the cables.

The bulk of the installation has been carried out with paper insulated lead covered cable. All cables in the basements and tunnels are braided overall and impregnated with fire resisting paint, while cables laid direct in the ground are hessian served and impregnated with compound. All pilot cables where long lengths are involved, are of the paper insulated lead covered type, but where short lengths are required v.i.r. cable has been used because it was more economical.

All the h.v. motors, and in many cases the larger l.v. motors, throughout the works are supplied direct from the appropriate switchgear in the substations, in each case to the main motor switch adjacent to or incorporated in the motor control equipment which often takes the form of a contactor board for a group of motors associated with a particular plant. These boards are regarded as parts of the electrical systems associated with the plants in question, and will therefore be referred to when dealing with the electrical applications to production in the various sections of the works. Smaller motors, however, are generally supplied from main and sub-distribution boards in the various buildings. These boards are usually English Electric fuse-switch equipments. Distribution for lighting is provided similarly.

For the 11 kV system restricted earth leakage protection of the instantaneous type is provided with back-up earth fault protection for system faults. The latter also covers busbar zone faults and has an inverse time-current characteristic to enable grading to be carried out with other system earth fault relays. The sectionalizing of the system has reduced operating times to a much lower figure than otherwise would have been the case. Balanced forms of protection are also provided for feeders,



The medium and low voltage a.c. system (415/240 V) is supplied from 800 kVA and 400 kVA transformers

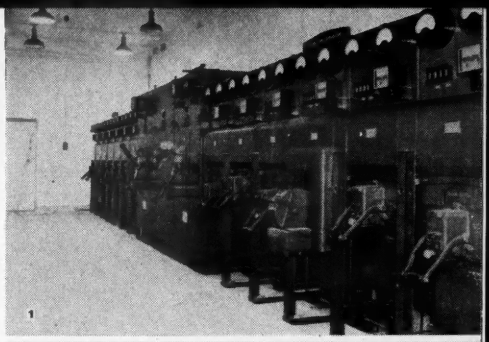
reactors and alternators, with back-up protection where necessary. Transformers supplying the 3·3 kV system have overcurrent relays, as well as balanced protection. Additional protection for transformers is by means of gas-operated (Buchholz) devices.

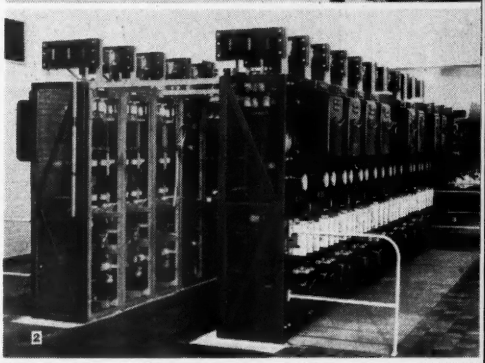
The insulation of the 3·3 kV system is designed to withstand full line voltage between any phase and earth. Each section of switchgear has a three-phase, five-limb, 3·3 kV/110 V 200 VA voltage transformer connected to it, with a l.v. tertiary winding for earth leakage indication. The neutral point of the h.v. winding is tied lightly to earth to provide a means of initiating audible and visual indication should an earth occur on one of the phases. Overcurrent protection is provided on feeders and transformers supplying the 415 V system. Generators are also provided with balanced protection, with back-up overload relays. Motors supplied direct are fitted with thermal overload and instantaneous type overcurrent relays. Undervoltage devices are also included, except on the power house auxiliary drives.

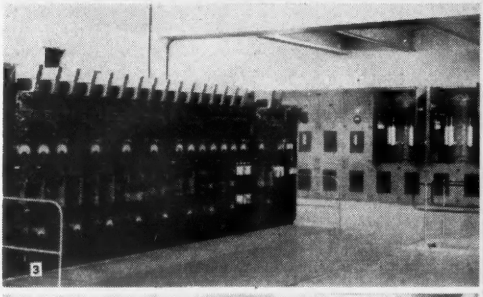
On the medium pressure a.c. system restricted earth leakage protection of the instantaneous type is provided on transformers supplied from the 11 kV system. Direct acting triple pole overload releases fitted with an oil filled dash pot to provide a time delay are generally used. H.r.c. fuses are connected in some circuits.

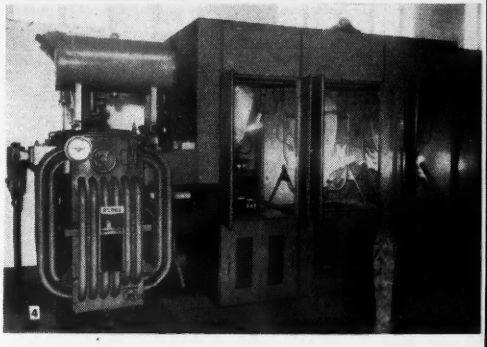
On the medium pressure d.c. system direct acting double pole overcurrent releases are provided with adjustable time delay devices.

There are at present three control rooms governing the supply to the three works sections, namely: (1) Strip mill control room, (2) Margam power station and (3) cold mill control room. These control rooms are manned by distribution controllers,







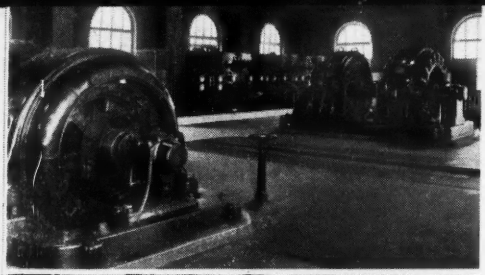


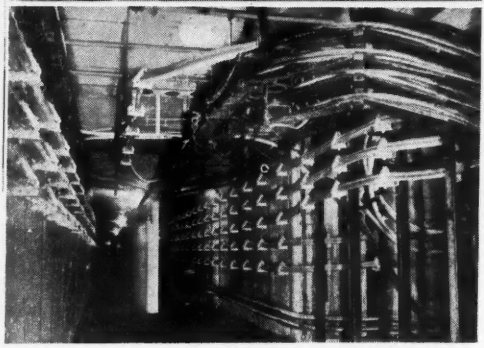
(1) In most substations l.v. 25 MVA manually operated vertical isolation oil circuit breaker switchboards have been installed

(2) Where substations constitute parts of motor rooms fire risk is reduced by the use of flat back l.v. switchboards

(3) The six d.c. substations are each equipped with a 1,600 kW 12-phase steel tank rectifier bank; left, back to back d.c. switchboard

(4) In order to transfer regenerated power to the mains a grid controlled invertor bulb (left) is included in the rectifier equipment at the Morfa (shown) and blast furnace d.c. substations





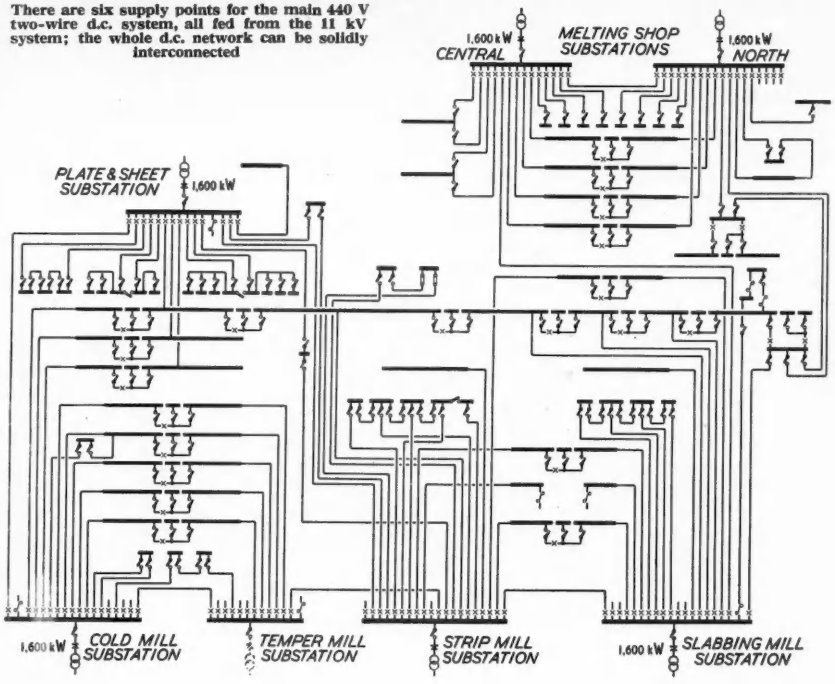
day and night, each of whom is responsible for the distribution of electricity in a defined area. By virtue of its strategic place in the system the strip mill control room is the main control centre. It controls the three 66 kV supplies to Cefn Gwrgan substation, and four of the six 11 kV outgoing circuits. It is situated outside the main strip mill motor room building, and faces east. The main 11 kV control board is of Reyrolle manufacture and is of "arcade" construction, forming three sides of a square. All protective relays, integrating and recording meters are mounted at the back of the panel, while on the front are mounted, in unit form, the necessary indicating instruments, semaphore control switches and auxiliary fuses.

The different substations and circuits under control are indicated on the appropriate part of the mimic diagram which appears

Above: **At the Port Talbot works section d.c. is supplied by m.g. sets fed from the 3·3 kV system**

Below: **Underground cable tunnels have been built in the foundations of the main buildings**

There are six supply points for the main 440 V two-wire d.c. system, all fed from the 11 kV system; the whole d.c. network can be solidly interconnected

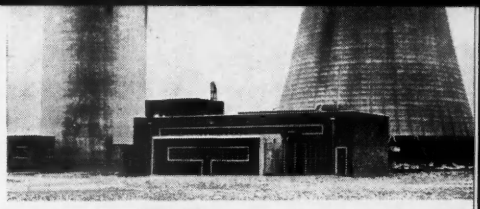


on the front of the control board. At both corners of and integral with this board there are similar sychronizing panels. Parallel with one side of the 11 kV control board is the 3·3 kV board controlling the Metropolitan-Vickers 3·3 kV switchgear in the strip mill substation. This is of Reyrolle manufacture and is of similar construction to the 11 kV control board. Opposite this board, and parallel with the other side of the 11 kV control board, is the tap-changing equipment for the transformers at Cefn Gwrgan substation.

Next to the tap-changing panel is mounted an English Electric board for the control and indication of all circuits at Cefn Gwrgan substation. Adjacent to this is a B.T.H. control board for the main finishing mill motors which are supplied from a 21,000 kW installation of B.T.H. mercury arc rectifiers. Instruments are fitted at the back of these panels for recording current and speed rolling schedules for each motor. In the centre of the room is a Clifford & Snell desk type annunciator panel. This is fitted with 72 separate " ways " for various indications and is also fitted with a " Loudaphone " installation for direct communication between the control room and other selected points on the system network. An Automatic Telephone Co.'s mimic diagram is mounted on the north wall and is of the mosaic type, enabling alterations in system conditions to be quickly represented.

The operation of the complete system is covered by the company's own rules, a copy of which is provided for all responsible persons who have to carry out work of any description on the system. All cables are taken in to a cable basement about 5ft high underneath the control room. The room is provided with forced ventilation and is fitted with G.E.C. cold cathode lighting. Ample natural daylight is provided by windows running the whole length of the east wall and by the provision of roof lantern lights. The floor is of wood block construction.

There are thirty-five h.v. substations included in the complete distribution system. Because of varying conditions it has not been possible to standardize the construction and layout of these substations, but the accompanying general arrangement drawing of the plate and sheet substation is fairly typical in principle. The building has 11in cavity walls, a concrete roof and a granolithic floor. The doors are of steel



Top: **Outdoor transformers are housed in the substation exterior bays fronted with two-inch mesh screens; Abbey pump house substation**

Bottom: **The corridor construction of the cold mill substation is generally indicative of the switchgear segregation in the substations**

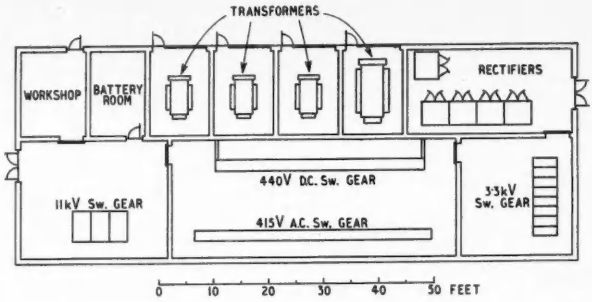
with " panic bolt " fittings on the inside. Non-opening type windows at high level are provided in every room and ventilation is by means of air bricks in the walls.

The 11 kV switchgear is Reyrolle 250 MVA metalclad solenoid operated horizontal draw-out oil circuit breaker equipment. It is situated in a compartment of its own in the south-east corner of the building, and is protected by Pyrene CO_2 fire extinguishing equipment. Immediately underneath the oil circuit breakers drainage pipes are provided, connected to a common main and then taken to a sump constructed in the ground outside the substation.

The cable trench at the rear of the switchgear is filled with sand to bury the cables and is then covered over with steel chequer plating. CO_2 nozzles are taken into the trench as a further precaution. All ducts leading into the trench are thoroughly sealed.

The 11 kV switchgear is operated by remote control from the strip mill control room. Protective relays are mounted on a swing frame underneath the switchgear.

The 3·3 kV switchgear comprises an eight panel Metrovick 75 MVA solenoid operated, horizontal draw-out oil circuit breaker switchboard with two manually operated oil immersed on-load isolators for the incoming feeders. This is on the north side of the compartment and ample room is provided on the south side for further extensions. A cable basement is provided underneath the 3·3 kV and medium pressure switchroom and the rectifier compartment. Owing to the comparatively small oil content of this type of switchgear it has not been considered necessary to provide oil drainage.



The layout of the plate and sheet substation is fairly typical in principle

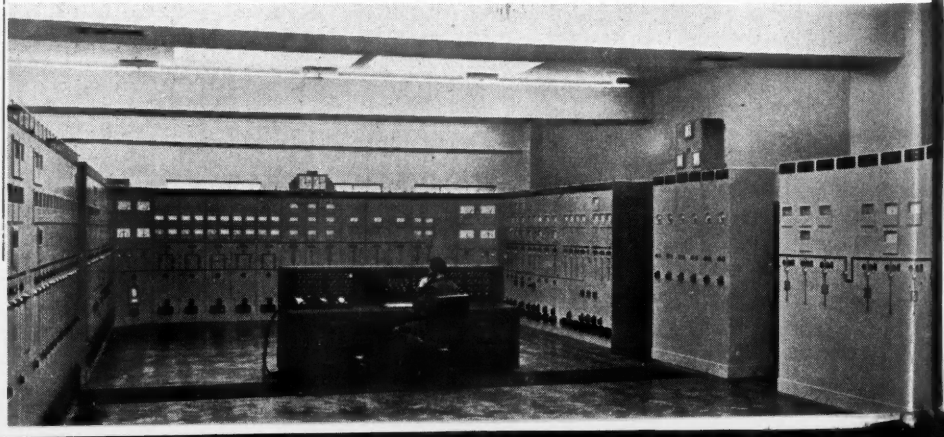
The medium pressure a.c. and d.c. switchboards are erected face to face. The 415 V a.c. switchgear is of English Electric manufacture and is arranged as an open type board with air circuit breakers and their associated isolators mounted in unit form. The 440 V d.c. Bertram Thomas switchgear is of similar flat-back construction. At the north-west corner of the building is a G.E.C. 11 kV/440 V d.c. 1,600 kW 12-phase rectifier and the rectifier for the sheet skin pass mill main drive which is a G.E.C. 400 kW grid-controlled unit. The rectifier tanks are cooled by centrifugal fans in a chamber below the rectifier. Air for this purpose is extracted from the cable basement below and the adjoining cable tunnels.

The transformers are mounted in bays on the west side of the building. Adequate oil drainage sumps surround the transformer; they are filled with sea-washed pebbles. The cable ducts are built into the concrete foundations and enter the cable basement. The transformer bays are provided at the front with 2in wire mesh screens fitted with wicket gates. The dividing walls between the transformers are of 9in brick construction.

South of the transformer bays is the battery room in which are situated Nife nickel-cadmium alkaline batteries. A 60 Ah, 240 V battery supplies the solenoids and the tripping circuits for the 11 kV switchgear are served from the battery in the strip mill substation. The tripping circuits for the 3·3 kV switchgear are supplied from a similar battery of 30 V output with 25 cells rated at 35 Ah. The batteries are equipped with Partridge Wilson automatic charging equipment for connection to the a.c. supply.

Lighting intensity in the substation is about 12 lumens/sq ft, and heating is by means of thermostatically controlled low

The strip mill or main control centre governs the three 66 kV supplies to Cefn Gwrgan substation and four of the 11 kV outgoing circuits; right to left, 66 kV, tap-changing and 11 kV control boards

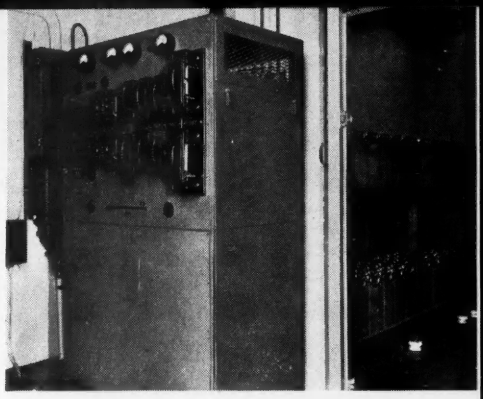


temperature heaters. Communication between compartments in the substation is by steel sliding doors.

The system power factor is corrected by synchronous motors and by running the alternators at Margam power station at their maximum permitted excitation, independently of the machine outputs.

It is expected that the half-hourly maximum demand of the system will be 60 MW at 0·93 lagging power factor, and that about 230 million kWh will be purchased annually from the South Wales Electricity Board, and another 70 million kWh generated at Margam.

Load summation is by Evershed & Vignoles electronic MW/MVAr summation indication equipment. This equipment is designed to indicate at the strip mill control room and the Margam power station the various summated loads in megawatts on the Margam power station, and the strip mill, cold mill and Ffrwdwyllt substations. By the operation of a press button at either of the indication points relays are energized at all transmitters, thereby altering the connections to the voltage circuits of the transmitter, so that the whole system then indicates megavars instead of megawatts. The nature of the indication, MW or MVAr, is shown at each indicator point by the illumination of one or two lamps.



The tripping circuits for the 11 kV switchgear are supplied from the battery in the strip mill substation; charging panel left

The consulting electrical engineers responsible for the design of the electrical system are McLellan & Partners. We are indebted to the Steel Company of Wales, Ltd., for permission to visit the works and to publish this article, and to the Electrical Engineering and Power Plant Departments for their help in obtaining the information, drawings and photographs.

Ulster Textile Mills

Commentary on Electrical Requirements

THE uses of electricity in flax spinning mills in Northern Ireland formed the subject of the inaugural address delivered at Belfast by Mr. S. McCracken (Metropolitan-Vickers Electrical Co., Ltd.) as the new chairman of the Northern Ireland Centre of the Institution of Electrical Engineers.

The address, which was illustrated with 46 lantern slides, commenced with statistics which indicated the value and extent of textile activities in Ulster. Mr. McCracken said that mainly as the result of the efforts of the Irish Linen Guild, exports of linen had increased remarkably. The yardage of cloth exported to the United States of America last year was nearly double the amount in the year before. About one-third of all textile workers in Ulster were now engaged in processing rayon and one-fifth of the total quantity of spun rayon fabric manufactured in the United Kingdom came from Northern Ireland. Such statistics were given in an attempt to put the industry in its correct perspective in order to emphasize the need to study its requirements in ensuring maximum operating efficiency consistent with reasonable first cost.

Turning to power supply generally, the speaker indicated that notwithstanding the need for processing steam the rising cost of coal was tending to render private generation less attractive than electricity purchased from public sources. Transformer capacity for the average size of mill was indicated. Switch-room arrangement could be conventional and emphasis was laid upon the advisability of making an early choice of cable types and routes.

Several methods of secondary distribution to driving motors were mentioned, Mr. McCracken appearing to favour mineral insulated cables in shallow trenches as being attractive and relatively inexpensive.

The particular importance to textile mills of power factor improvement was indicated, as well as a variety of methods by which such correction could be undertaken. Lantern slides helped Mr. McCracken to describe the scutching of flax and its preparation for spinning, reeling, drying, dyeing and finishing, with commentaries on the manner in which the electricity was taken to and used for driving the intricate machinery involved.

The chairman appeared to have encountered some very confused thinking about the correct types of motor to be employed in mills of this kind. He indicated the types favoured for different classes of work, remarking that simplicity and ease of maintenance were preferable to technical advantages which might lead to unforeseen difficulties.

Mr. McCracken believed that few engineers, except those intimately connected with the textile industry, appreciated the order of the power requirements of a spinning mill. The object of his address and illustrations was, therefore, to dispel any idea that spinning mill installations were of little account as engineering projects.

Artificial Illumination of Plants

Mercury-vapour Irradiation Unit

FOR speeding the growth of plants the General Electric Co., Ltd., has designed an illuminating unit comprising an "Osram" mercury vapour lamp of a type used in street lighting arranged for horizontal burning.

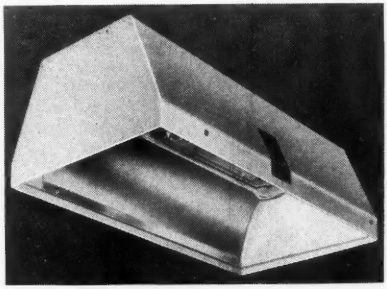
The apparatus is most economically used in connection with seedlings. With a typical ten-lamp installation, a total of 1,400 tomato seedlings can be illuminated at a time. For a treatment of twenty nights, ten hours a night, and for three successive batches of seedlings, a total of 4,200 can be treated, enough for more than a quarter of an acre. Plants treated in this manner have flowered two weeks or more ahead of non-illuminated plants, and over the whole season they are generally more than a truss ahead.

The following results were obtained in the seasons of 1947 and 1948, on the variety "Potentate," using John Innes No. 1 compost and 3½in pots.

	Yield in pounds weight per acre		Increased yield by illumination
1947	Illuminated in seedling stage	Not illuminated in seedling stage	Per cent
Early fruit	24,744	15,876	56
Total crop	96,336	98,888	3
1948			
Early fruit	35,736	16,536	116
Total crop	99,660	85,176	17

Preliminary trials indicate that increased yields can also be obtained with cucumbers.

The plant irradiation unit, complete with lamp and starting equipment (for a.c.), costs £15 10s 5d and additional lamps £3 3s. The life of the lamp, used in the manner described, would average 4–5 years, and the life of the other equipment would be considerably longer. The total cost of a ten-lamp installation, assuming that its total life was only ten years and that during this period a dozen spare lamps would be needed, may be estimated as follows with electricity at 1d/kWh. Capital cost, £155 4s 2d; spare lamps, £37 16s; power costs for ten years, £100; total £293 0s 2d. The cost per annum would therefore be approximately £30, for which sum sufficient plants to cover a quarter of an acre could be treated. Taking the extra yield on this area to be only 50 per cent and for the early fruit only, about 2,000 lb of extra fruit would be obtained per annum, which would clearly make the installation a sound economic proposition. To this approximate cost would have to be added the cost of installing the plant.



G.E.C. illuminating unit for accelerating plant growth

VIEWS on the NEWS

By REFLECTOR

I HAVE doubts whether the half-hour item "Focus on Power Cuts" in the B.B.C.'s Light Programme last Friday will have the desired effects—to soften, by explanation, the impact of power cuts and to keep domestic consumers off the peak. Some listeners will have found the semi-patronizing semi-sententious method of presentation a little irritating and, in any event, there was too much of it. The brief factual statements by Lord Citrine, Col. B. H. Leeson, Sir Norman Kipping and others formed the essence of the broadcast but they were rather swamped by the "dramatization" which the B.B.C. considers essential to these programmes.

* * *

A nationalized undertaking is always fair game for some sections of the daily Press. The absence of power cuts on the frosty, foggy mornings last week led to many suggestions that there was some connection between this and the General Election. Even when explanations by B.E.A. spokesmen were also published they were often given with a certain amount of reserve. It is the fact, of course, that it is at this time of year that plant taken out for summer overhaul is put back into service ready for the winter. Actually, without ulterior motive, arrangements were made by the B.E.A. to complete the overhaul a little earlier than usual. The position was also eased by there being less plant out of action through breakdowns.

* * *

Great Britain has the most highly mechanized agriculture in the world, according to the president of the Institution of British Agricultural Engineers, Mr. F. E. Rowland, who has referred to the transformation of the rural scene, largely through the use of electricity for lighting and heating and for power in farm buildings. This seems to me another way of saying that the benefits coming from electrification cannot be measured only on a kWh basis. It is all the greater pity that restrictions on capital expenditure have materially checked further progress for the time being. Following the precedent set by urban industries, much of the power now provided by other means should sooner or later come the electrical way.

* * *

Memories of more spacious days are awakened by a report in the *Birmingham Gazette* that the Midlands Electricity Board is to provide illuminations for a "Bonfire Night firework display and stag-roasting" at Far Forest, near Bewdley. Villagers who are waiting for an electricity supply have protested against what they call a waste of time and money. The Board has replied that no waste is involved. The inhabitants of Far Forest asked for the illuminations and will pay for them; and the local showroom staff have the equipment and would probably set it up after their normal hours. The M.E.B. official who explained this said that it was a matter of maintaining good public relations and would not have the slightest effect on development schemes.

* * *

Opposition to the new block tariffs which the Electricity Boards are introducing continues to come from all quarters. The official organ of the Electrical Trades Union quotes Mr. J. Hobday, a Nottingham official of the E.T.U., as saying he

> "regarded the new tariff as a direct knock at the old age pensioners who would find that the more they economized the more expensive their electricity would be. The tariff would, moreover, encourage people who could not afford £4 for a power plug to use adaptors and work fires off the light."

It was unnecessary of the *Electron* to add that Mr. Hobday's action in this matter was accorded wide and prominent publicity in Nottingham's Press and in the B.B.C.'s Midland news.

ELECTRICITY BOARDS' REPORTS

System Reinforcement Essential

FROM the following further summaries of the 1950–51 reports of Electricity Boards it will be seen that the effects of capital expenditure restrictions are again the principal theme.

EASTERN

Although it was aware that the full capital investment programme could not be carried out, the Eastern Board did not learn until 17th August, 1950, that it would have to cut its expenditure for the year to 80 per cent of what was considered essential. Thus when revising its programme the Board endeavoured to avoid interfering with schemes for supplying electricity to people who had been led to believe that a service would be given by the end of the year. The reduction of expenditure was accordingly achieved mainly by slowing down system reinforcements, but any further delay in this direction is likely to have serious consequences. The Board, in fact, says that unless there is a substantial increase in the amount of capital spent on reinforcement "there must be a most serious risk of widespread and prolonged failures of supply to consumers in many parts of the Board's area."

Reinforcement schemes agreed with the Central Authority during the year included 132/33 kV substations at West Chelmsford (for Mid-Essex area), Hemel Hempstead (for new town and to reinforce supply to Cheshunt and Berkhamsted) and at Hatfield (for new town development at Hatfield and Welwyn and to meet load increase at St. Albans). At Watford two 60,000 kVA transformers are to be installed with 33 kV feeders to various points on the Watford system.

Load shedding by disconnection was necessary on 51 days, though on 14 days only a small part of the Area was affected; the most severe cuts were on 13th December when five stages of reduction (25 per cent) were called for.

Dealing with rural development, the report states that the number of farms added (1,149) was 128 fewer than in the previous year. Since vesting date there has been an overall increase of some 40 per cent and the total is now 13,853. Supplies were made available last year to another 181 villages and hamlets.

In all, there was a net increase in the number of consumers of 54,428. This, it may be mentioned, was more than in any other Area, the second largest number of new consumers being connected in the Midlands (45,571).

The value of contracting work and the sale of fittings showed a substantial increase, the total rising from £3,856,970 to £4,422,065 and the surplus from £129,781 to £149,279. The financial section of the report also records that gross capital expenditure during 1950–51 amounted to £4,928,943 against £5,505,598 the year before. Another point discerned is that income per kWh sold decreased from 1·399d to 1·370d and expenditure from 1·370d to 1·364d. Tariff variations were introduced in January, 1951, for the dual purpose of securing increased revenue and removing certain anomalies.

MIDLANDS

Major industrial and other load developments in the Midlands Area have brought in their train the need for greater system reinforcement and how to fulfil both out of the limited capital expenditure permitted by the Government is a problem which faces the Board. Between the two, the Board decided that reinforcement must have priority, and a warning is given that with a continuation of restrictions on capital expenditure there is a danger that the Board will not be able to meet all demands from industrial consumers and for new houses.

Last year collieries, the iron and steel, pottery and chemical industries, water pumping schemes and housing provided major load increases, while other developments concerned grass drying, arc welding, refrigeration and water heating. In Birmingham alone schemes were sanctioned for supplying 5,374 houses at West Heath, Bartley Green, Sheldon and Northfield at a cost of £303,230, other housing projects at Wolverhampton, Walsall and Stoke involving an aggregate expenditure of £78,641. Large industrial schemes included additional supplies to factories at Witton (£36,518), to plastics, tube and glass factories at Oldbury and Smethwick (£33,335), to sheet steel rolling works at Tipton (£47,000), and to sheet metal works at Wellington (£31,325). In the Forest of Dean supplies to 1,562 premises, including 110 farms, four sawmills and two quarries, require an expenditure of £137,646 and supplies to 496 premises in thirty-eight villages south-west of Shrewsbury are costing £64,437. Considerable development was also seen in street lighting, an additional 7,048 points being connected (total at March last, 61,440).

In the matter of research, an experimental station has been set up by the Board for the testing of American high-speed reclosers for rural h.v. networks. In conjunction with the manufacturer, 10,000 yd of aluminium sheathed 33 kV impregnated gas pressure cable was laid in the Birmingham Sub-Area. The sizes and types of cables up to 22 kV and the sizes of

ervice lines have been standardized, as also have he charges for the latter when exceeding the ength provided free of cost. Mainly for rural onsumers, a minimum revenue scheme has een instituted in place of capital contributions nd line rentals. The report records that .h.f. radio communication with service vans as been extended " with remarkable results."

Dealing with costs, it is pointed out that the evised bulk supply tariff not only represents a ubstantial increase in the kW demand charge ut deprives the Board of the 5 per cent rebate reviously enjoyed (10 per cent for 1948–49). ompared with before vesting day, the extra ost for 1950–51 for a similar supply is £2,060,000 nd on the still further increased bulk tariff for 951–52 this additional cost becomes £2,650,000.

EAST MIDLANDS

In its report for the past year the East Midlands Board expresses grave concern at the increased frequency of load shedding which occurred in some part of the Area during every month of 1950–51 except July. In Lincolnshire, because of loading conditions on the Central Authority's 132 kV north–south interconnector, there was heavier load shedding than in other parts of the Area. In Lincoln itself one stage (5 per cent) was ordered on 138 days and in Bourne on 142 days, and on two days there were six stages (30 per cent reduction). Due to failures at bulk supply points (Staythorpe, St. Swithin's and Longford), there were three major interruptions.

System developments during the year included the approval of new bulk supply points at Boston, Grantham, Tamworth and Kibworth, while additional points in Northamptonshire are under consideration. Among e.h.v. extensions completed were 66 kV circuits from Staythorpe to Kirkby and from Staythorpe to Hawton West and East. Four new 33/11 kV substations for affording supplies to Bilsthorpe, Clipstone, Thoresby and Arley Collieries and several schemes for reinforcing the 11 and 6·6 kV networks were approved. The Board purchased 7·7 million kWh at an average price of 0·333d/kWh from the Renishaw Iron Co. (waste heat generation) and a further agreement for the purchase of surplus energy was made with the East Midlands Gas Board.

Dealing with the Government decision to restrict capital investment, the report observes that the continuance of this policy will materially prejudice the Board's endeavours to carry out the provisions of the Electricity Act, 1947.

During the year eighty-three new special agreements were negotiated, representing a total new load of approximately 24,000 kVA, including four supplies to collieries totalling 7,000 kVA. The number of farms connected was 1,197, making the total served 14,436. Three large rural schemes were authorized by the Board in the Lincolnshire Sub-Area by which supplies will eventually be afforded to thirty-four villages and hamlets, including 244 farms. Purchases by consumers under the credit sales scheme totalled £556,239 and an extension to include assisted wiring came into limited operation, 45 installations being completed. The number of cookers on hire increased by 7,637 to 134,702 and washboilers by 2,745 to 27,349; for the latter a standard hire scheme was introduced at a quarterly rental of 4s.

Standard specifications and prices for work undertaken by contractors on behalf of the Board were introduced and a measure of uniformity was attained in the inspection and testing of consumers' installations.

SOUTH WALES

There was an advance of nearly 12½ per cent last year in the requirements of industrial consumers in the South Wales Area; these absorbed almost 80 per cent of the total sales of electricity. New mills of the Northern Aluminium Co., Ltd., at Rogerstone, commissioned during 1950, are among the largest in the country, with a maximum demand of over 20,000 kW on restricted output. Mechanization of mines entailed further demands and about 8,400 kVA of additional capacity was made available to the National Coal Board. Actually, the m.d. of 580,034 kW represented a smaller increase than in 1949–50 (8 per cent against 16·7 per cent) but a further considerable increase is fairly certain during the current year, the new works of the Steel Company of Wales at Margam and Trostre alone accounting for 45,000 kW.

The Board has made the fulfilment of the demands of industry, on which the Area depends economically, a first call upon the limited capital available, after the urgent needs of system reinforcement have been met. It says, however, that there is a serious prospect that unless the present capital position is alleviated the Board may be unable to provide adequately for new housing and that electrification of rural areas will have to be postponed. With regard to the latter, the Board had prepared an initial programme of works in three stages, the total estimated cost of which was £300,000. A period of two years was tentatively given for carrying out this plan, but the Board has come to the conclusion that it is unlikely that this can now be accomplished—regretfully, because it is " fully conscious of the urgent need of rural communities for supplies of electricity."

Important engineering schemes initiated or completed during the year included two 33 kV lines between the new Crumlin grid substation and the Board's system at Newbridge and two to a new substation near Newport. Arrangements were made for a second 66 kV line between Llynfi power station and Margam and work was started on two 33 kV lines for additional supplies to the large oil refinery at Neath as well as on the construction of a new ten-mile 33 kV line between Carmarthen and Rhos. A scheme was prepared for equipping the whole

of the Board's 66 kV network with high-speed feeder protection of the unit type with the object of accelerating fault clearance. Location of faults, particularly in rural areas, has been greatly accelerated since the commissioning of the Board's v.h.f. radio station at Fforestfach Control Centre.

In view of increased costs, particularly the revised bulk supply tariff which it is estimated will add £234,000 to the payments by the Board in 1951–52, increases in charges were brought into effect in April, 1951, as an interim measure pending the introduction of standardized tariffs.

MERSEYSIDE AND NORTH WALES

Rural development is a particular concern of the North Wales and Merseyside Board. Already much has been done; for example, in Nos. 4 and 5 Sub-Areas, which include the counties of Anglesey, Caernarvon, Denbigh, Flint, Merioneth, and Montgomery, and parts of Cardiganshire, Cheshire and Shropshire, 25,018 new consumers have been connected in the three years since vesting day and consumption in these Sub-Areas has increased by 54 per cent.

Now, under the capital investment restrictions, expenditure on rural construction is likely to be cut to half the rate envisaged when the plan for North Wales was prepared in 1948. In view of the very special needs of the Area the Board considers that as soon as the economic situation warrants it the capital allocated annually for this work should be restored to the full amount necessary for carrying out the original programme.

Besides rural development, much essential work, including necessary system reinforcement, has had to be postponed, "a process which cannot be continued indefinitely."

During last year the Board authorized expenditure on reinforcement schemes aggregating £1,408,501 and at the end of the year the estimated cost of schemes outstanding was £4,982,108. Works carried out included new 33 kV cables and transforming stations in Liverpool, Warrington, Runcorn, Birkenhead, Crewe, Rhuddlan and elsewhere. Progress was made with the re-insulation of 20 kV lines in N.W. Wales and 28 circuit miles were made suitable for 33 kV operation.

Of sixteen schemes for supplying large housing estates referred to in the previous report, four were completed, and plans for serving eleven new schemes were authorized. In the sphere of consumer service mention is made of the introduction throughout the Area of a standard "after hours" service. It was necessary to curtail hiring facilities owing to capital limitations but arrangements for reconditioning were extended to meet consumers' needs as far as possible. In the Area as a whole 25,050 consumers were connected, making the total 704,076.

Extension of the use of signals transmitted over the mains has taken place in the Chester, Wallasey and Birkenhead Districts for the control of water heaters at times of peak load and it is now possible to avoid disconnecting consumers for one stage of load shedding in the Wallasey District.

YORKSHIRE

To meet the increasing demands of existing consumers and provide supplies to new ones the Yorkshire Board estimated that capital expenditure amounting to £6,724,000 would be required during 1950–51. After being reduced, at the request of the B.E.A., to £5,130,000 this sum was finally cut by a further 10 per cent to £4,617,000, and the Board in its report draws attention to the serious effects of this drastic limitation.

It is noted that the present load carried by the system is more than 75 per cent greater than in 1939, though very little reinforcement has been possible. This involves the acceptance of risks which would not normally be taken. A survey of the Board's 97 primary substations has shown very serious overloading.

Load shedding was rather worse in the Board's Area than some other parts of the country, varying degrees of reduction being made on 142 days. Immediately after "summer time" ended on 22nd October, 1950, the position rapidly deteriorated and shedding up to four stages twice each day became almost routine, while up to five and six stages were necessary on occasions. From 1st January, 1951, when industrialists were asked to afford 20 per cent relief by load spreading, there was an improvement and the third stage was rarely called for.

In view of the seriousness of the position during the winter the Board discontinued the general sale of electric radiators and stipulated that all future combined cooker and water heater installations should have a change-over switch. A licence was obtained from the Postmaster General to allow radio equipment to be used for the transmission of power cut warnings.

Approval was given during the year to 2,704 schemes for the reinforcement or extension of the distribution system, including sixteen new primary substations and associated 33 or 66 kV mains reinforcement. During the year the Board was notified of an additional 42,700 kW of installed industrial load, among many large loads approved being a 10,000 kVA supply for a new steel rolling mill plant. Construction work has taken place at Aldham substation, one of the points from which a supply will be given for the Sheffield–Manchester electrified line.

There was a net increase of 34,592 in the number of consumers. Under the Board's five-year development plan a supply was afforded to 55 villages (about half the number anticipated before the capital expenditure restrictions were imposed) and 960 farms. A single domestic tariff of the variable block type was submitted to the Consultative Council for consideration but agreement was not reached.

Ultrasonic Tyre Testing

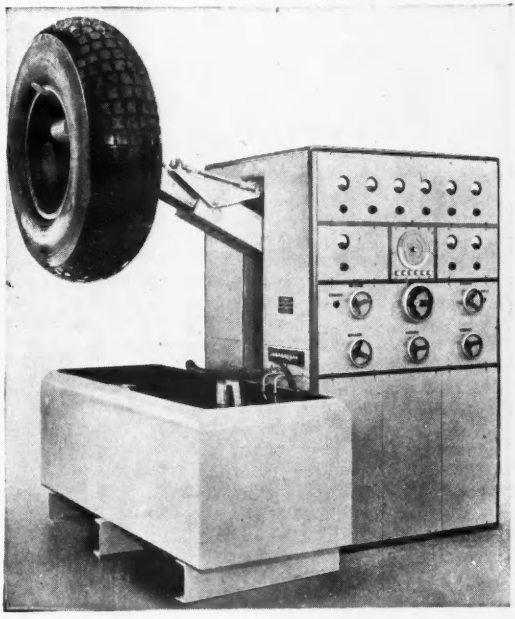
Dunlop–G.E.C. Equipment

AN instrument which has recently been put into operation in the Birmingham works of the Dunlop Rubber Co., Ltd., utilizes ultrasonic waves for the non-destructive production testing of aircraft and motor vehicle tyres of all types. Developed jointly by the Dunlop Research Centre and the General Electric Co., Ltd., the method depends on the fact that any internal discontinuity (e.g., imperfect bonding between rubber and fabric) will lead to the presence of an air film which will cause almost 100 per cent reflection of ultrasonic waves which reach it. With new tyres a fault of this type is rare, but with used tyres it is common and may make it inadvisable to renew the treads, despite the fact that the tyre is superficially sound.

The equipment, which can detect faults having an area of $\frac{3}{8}$in by $\frac{3}{8}$in or more, comprises a steel cabinet containing a 50 kc/s ultrasonic generator and valve amplifiers, together with pneumatic handling equipment for lowering the tyres into an adjacent tank of water, where they are tested. The reason for using the water bath is that water produces a good transmission path between transmitter and receiver, together with reasonable acoustic matching with the rubber. This means that there is negligible absorption or reflection at the water/rubber boundary. If a dry contact were used it would be almost impossible to exclude air. This would result in nearly 100 per cent reflection of the wave, which would be unable to pass freely into the rubber.

Projecting from the front of the cabinet is a pneumatically operated extensible arm, which can be given a cycle of operations to enable it to move outwards and to project beyond the tank so that a tyre can be loaded on to it. The arm then lifts the tyre, moves it inwards and lowers it on to two rollers which are mounted in the tank, above the water. These rollers rotate the tyre at up to 10 r.p.m. during a test and are driven by an $\frac{1}{8}$ h.p. motor, through reduction gears. The reason for the speed range is that when a tyre is first immersed it is desirable to revolve it quickly for wetting purposes, and then to slow down for an ultrasonic test, and if necessary, to drop to "very slow" or "stop" for precise location of a flaw.

The ultrasonic transmitter head houses a $\frac{5}{8}$in diameter quartz crystal mounted in a brass holder placed 1in from the rubber,



General view of the instrument showing the pneumatic loading equipment in operation

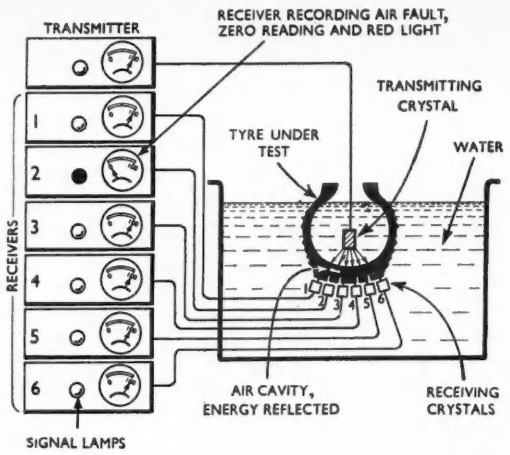


Diagram illustrating the basic principle of the Dunlop-G.E.C. ultrasonic tyre tester

in the well of the tyre, which is under the water. The ultrasonic beam is radiated at an angle of 120 deg and a single transmitter within the tyre can be used with up to six receiving crystals spaced around the outer wall. Leads are taken from each of the receiving crystals, to separate amplifiers, and the outputs of these are used for visual indication on six meters and for the operation of six alarm circuits each consisting of a relay and a red indicator lamp. Each amplifier has independent controls for setting the meter indication and point at which the alarm lamp lights.

The technique of using the equipment is that after the tyre has been lowered into the tank it is rotated quickly to wet it and remove air bubbles. If desired, a small amount of non-foaming wetting agent can be added to the water. The ultrasonic generator is then adjusted to give a meter indication of about 80 per cent of full scale deflection on each of the receiver indicators. It should be noted that the apparatus does not depend in any degree on an absolute calibration but purely on the fact that an area of the tyre can be considered as " good " and then all other parts are tested relative to this portion.

Next, the speed of rotation is reduced, according to the size of the tyre and the size of the fault which is being sought. A large aeroplane tyre (or any tyre where areas greater than 1in square are being sought) can be rotated at 6 r.p.m., but lower speeds have been found to be better for smaller tyres or for smaller areas. Each revolution of the tyre results in about a 90 deg arc of cross section being scanned by the crystals and means are provided so that the transmitter and receiver crystals can be rocked about an axis by means of an electric motor, to enable the whole tyre to be examined in a few revolutions.

Small variations in the tyre structure cause small and rapid variations in the meter indications when the equipment is in use, but an operator can soon learn to distinguish between these and true faults such as actual or incipient looseness between layers of fabric.

After a test has been completed, the water within the well of the tyre is removed by means of a small pump and the pneumatic lifting equipment operates to remove the tyre from the test tank, back on to a trolley or conveyor.

The pneumatic handling equipment is designed to operate off the works compressed air main and is automatically controlled by cam-operated air valves, with means for adjusting the speed of the loading or unloading cycle. The ultrasonic generator is provided in duplicate, together with a spare receiver amplifier and meter panel, so that the electronic equipment of the tester can be serviced without interrupting production.

Units and Standards of Measurement

A SHORT series of useful pamphlets describing the units and standards of measurement employed at the National Physical Laboratory is being published for the Department of Scientific and Industrial Research. The first (I—Length, Mass, Time) is obtainable from H.M. Stationery Office, price 10½d post free (25 cents U.S.A.). It is not only concerned with those fundamentals, but additionally defines such derivative units as those of volume, density and specific gravity while also dealing with the acceleration due to gravity as well as with force and barometric pressure.

PERSONAL and SOCIAL

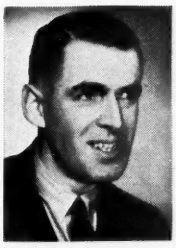
News of Men and Women of the Industry

THE appointment of **Mr. Arthur Parkinson** as a director of Crompton Parkinson, Ltd., is announced. Mr. Parkinson is the only son of the late Mr. Frank Parkinson, the former chairman of the board. He has been an executive director of the company since 1946.

Mr. J. W. T. Walsh, D.Sc., M.A., M.I.E.E., a principal scientific officer in the Electricity Department of the National Physical Laboratory, where he has been in charge of the Photometry Division, has retired. Dr. Walsh is known to lighting engineers throughout the world as the author of several works on illumination and photometry. He received his education at Hampton Grammar School and at Merton College, Oxford, and joined the scientific staff of the N.P.L. in 1913. He is a past president of the Illuminating Engineering Society, late secretary of the International Commission on Illumination, a member of the Ministry of Transport Departmental Committee on Street Lighting and a member of the Home Office Departmental Committee on Lighting in Factories. Among his best-known works are "Elementary Principles of Lighting and Photometry" and "Photometry." Dr. Walsh will still maintain his interest in illuminating engineering. His new address is 2, Cambridge Crescent, Teddington, Middx. (telephone: Kingston 1766).

Dr. J. W. T. Walsh

Mr. R. P. Sayers, F.I.E.S., M.S.M.A., has relinquished his position as assistant commercial manager of the Light Group of Philips Electrical, Ltd., to join Ashley Accessories, Ltd., of Ulverston, Lancs., as sales manager. Mr. Sayers has been active in developing the use and sales of discharge and fluorescent lamps.



Mr. R. P. Sayers

Mr. A. D. Monk was recently appointed manager of the Leicester branch of the Simplex Electric Co., Ltd. Mr. Monk, who had been acting branch manager at Leicester since August, 1950, joined Simplex in 1938. During the last war he served with the R.A. Heavy A.A. in France, and after Dunkirk was sent out to the Middle East. In 1946 Mr. Monk re-joined Simplex as a sales representative.

Mr. J. E. Price, A.M.I.E.E., who has been with Lancashire Dynamo & Crypto (Mfg.), Ltd., for thirty-six years has been elected a director of Malcolm & Allan (London), Ltd., an associated Lancashire Dynamo company. Mr. Price will continue to operate from the London office of L.D.C. which he joined originally in 1924 after twelve years at the company's Trafford Park works where he also served his apprenticeship.

Mr. R. W. Ell has been appointed contracts manager of the Foster Switchgear Division of Crypton Equipment, Ltd., and will operate from that company's London office where he will act in a technical sales and advisory capacity for the complete range of Foster H.I. switchgear. Mr. Ell joined, what is now Foster Transformers & Switchgear, Ltd., which, like Crypton, is in the L.D.C. group, in December, 1938, as senior draughtsman engaged on switchgear and kiosks. In 1939, he became design and contracts engineer in the Switchgear Department, and was made chief switchboard designer in 1946. Two years later he was appointed assistant contracts manager, dealing with both transformers and switchgear.

Mr. R. W. Ell

Mr. Walker L. Cisler, at present executive vice-president of the Detroit Edison Co., Detroit, United States, has been nominated president and general manager of the company as from 1st December next. He will succeed **Mr. J. W. Parker** who has been president since 1944.

Mr. Alexander Logan, who has been deputy area manager for the Cowal area of the

North of Scotland Hydro-Electric Board, has been appointed area manager in succession to **Mr. A. Earls,** who has resigned to take up an appointment in Nigeria. Mr. Logan's office will be at Electricity Works, Dunoon.

Mr. R. Hewetson has resigned from the board of Marco Refrigerators, Ltd. He will, however, remain with the company in the capacity of chief engineer.

Mr. A. Edwards has been appointed a director of Sangamo Weston, Ltd.

The director and secretary of the British Refrigeration Association, **Mr. E. G. Batt,** visited Glasgow on 30th October to present book prizes provided by the Council of the Association to successful students taking the refrigeration course at the Stow College School of Engineering. He stressed the importance of technical training and its value to the students in their careers and paid high tribute to the Principal of the College, Dr. William S. Cormack and his staff.

Mr. N. C. Robertson, deputy managing director of E. K. Cole, Ltd., has accepted the position of Director General of Electronics Production, Ministry of Supply. Mr. Robertson will take over his new duties, which are on a voluntary basis, early in November. Mr. Robertson will be responsible for the production of all radio, radar, telecommunication and electronic equipment for the Ministry of Supply. The creation of this Directorship was announced in the House of Commons on 23rd July, following recommendations made by the Select Committee on Estimates.

Mr. N. C. Robertson

Mr. Robertson has been connected with the radio industry since 1924, when he was apprenticed to the Sterling Telephone and Electric Co., Ltd. From 1926 to 28 he was an engineer with Marconi's Wireless Telegraph Co., Ltd., and from 1928 to 30 chief inspector with Kolster Brandes. In 1930 he joined E. K. Cole, Ltd., with whom he has been successively chief inspector, production manager, works manager, director (since 1943) and deputy managing director (since 1945). He has been closely connected with the production of radar equipment from its very early stages. He was awarded the M.B.E. in 1944. Mr. Robertson is a Fellow of the Royal Society of Arts and an Associate of the Institution of Electrical Engineers.

Mr. C. I. C. Bosanquet, who has been appointed Rector of King's College, University of Durham, as from October, 1952, was a director of the former North Eastern Electric Supply Co., Ltd., from 1945 to 1948. He is now a member of the North Eastern Electricity Board.

Mr. James F. Magee, who has been representative in London of the Sydney County Council (which is responsible for electricity supply in the city and suburbs), is returning to Sydney before the end of the year. The generating side of the Council's undertaking is being transferred to the Electricity Commission of New South Wales but Mr. Magee elected not to join the Commission's service at this stage. Instead, he has been appointed to the senior position of distribution engineer to the Council with responsibility for such activities as project supervision of the 33 kV transmission and distribution networks, financial matters relating to the cost of giving supply, the determination of rate structures, planning and investigations, and negotiation of large power supply contracts.

Mr. J. F. Magee

The English Electric Co., Ltd., announces the appointment of **Mr. H. C. Timewell** as manager of their Domestic Appliance Division. For ten years Mr. Timewell was sales manager of the International Refrigerator Co., Ltd. During the war he served in the Royal Navy in a technical capacity. He was a founder member of Design Research Unit.

Mr. H. C. Timewell

We regret that there were two errors in our last week's report of the annual dinner of the **Johnson & Phillips Foremen's Association.** Mr. J. N. Dean is managing director of the Telegraph Construction and Maintenance Co., Ltd., not chairman, and Dr. G. A. V. Sowter is manager of the Metals Division, not a director, of the same company.

Sir James Moir Mackenzie, K.B.E., C.M.G., deputy director-general of the Federation of British Industries, retires this month after thirty years' service.

The directors of Decca Radar, Ltd., announce that **Mr. C. H. T. Johnson** and **Mr. S. R. Tanner** have been appointed to the board of the company, as from 26th October.

OBITUARY

Mr. P. E. Banting.—The death occurred on 18th October, at the age of seventy-two, of Mr. Percy Everett Banting. Mr. Banting joined the British Thomson-Houston Co., Ltd., as a tester in 1902, and later was engaged in various engineering and commercial departments until 1914. He served with the Royal Garrison Artillery in the 1914-18 war, and held the rank of lieut.-colonel. He had the distinction of being awarded the Russian Vladimir Medal. Returning to the B.T.H. Co., Mr. Banting was appointed manager of the Manchester district office, which position he relinquished in the early twenties to become a partner in the London firm of Banting and Tresilian, Ltd.

Mrs. V. I. Ripley.—We learn with regret from her husband, Mr. R. V. Ripley, A.M.I.E.E., that Mrs. Viola Ripley, B.Sc., died on 12th October. In the years before the last war we published several articles by Mrs. Ripley, mainly about domestic electrical development overseas.

Mr. Gordon Hughes, managing director of Gordon Hughes Electrical Co., Birmingham, which he founded in 1921, died on 25th October at the age of fifty-six.

Dr. H. W. Malcolm.—The death occurred on 25th October at the age of seventy, of Mr. Henry William Malcolm, M.A., Ph.D., D.Sc., A.M.I.E.E.

WILLS

Mr. W. M. Lydall, M.I.E.E., chairman and managing director of the Yorkshire Electric Transformer Co., Ltd., who died on 11th August last, left £44,677 gross (£39,735 net).

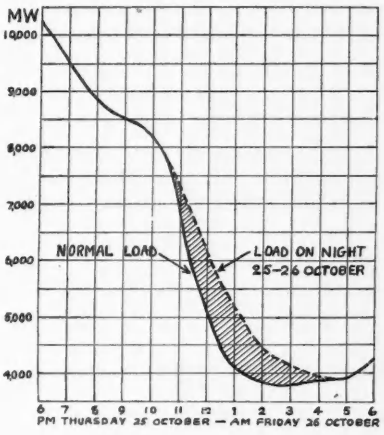
Mr. W. H. Wigston, director of the electrical division of the Britannia Engineering Co., Luton, and formerly for some years chairman of the Electric Discharge Lamp Auxiliaries Council, who died on 26th June last, left £4,725 gross (£3,034 net).

French Hydro-Electric Development

THE Société des Ingénieurs Civils de France (British Section), is holding a meeting at the Institution of Electrical Engineers, Savoy Place, London, W.C.2, on Friday next, at 5.30 p.m. when Monsieur R. Brongniart will present a paper entitled "The Development of Hydraulic Power Production and High Tension Transmission in France."

Election Night Load Curve

ONE consequence of the General Election was the unusual rise in the B.E.A. load through people sitting up to hear the results. One of the accompanying curves shows what happened on the night of 25th–26th October; the other is the normal record. It is estimated that the extra consumption was 3·7 million kWh.



Comparative load curves

Technical Student Exchanges

THE fourth annual report of the International Association for the Exchange of Students for Technical Experience (I.A.E.S.T.E.) for 1951 has been distributed to sixteen countries and also circulated to others applying for membership next year.

It presents a comprehensive picture of the support which has been given internationally to the efforts of the Association. The industries concerned have together provided more than £110,000 by way of payment to the students who took part in the exchanges this year. British universities and colleges now co-operating number 22, and 422 students were sent abroad to obtain further experience this summer, an increase of 69, while the 457 students received in Britain represent an increase of 89.

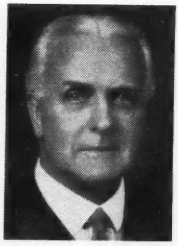
The report indicates that expansion continues, both geographically and academically, the total number of students exchanged having increased from 1,672 last summer to 2,433 this summer.

The central office of this project is at Imperial College, South Kensington, London, S.W.7, and Mr. J. Newby is the general secretary.

The New Parliament

Members Associated with Electrical Industry

Sir Peter Bennett



Sir Arnold Gridley

Mr. Oliver Lyttelton

Mr. F. J. Erroll

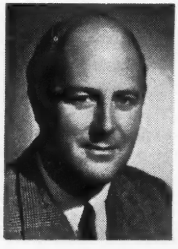
SO far as electrical representation in the House of Commons is concerned little change has resulted from the General Election. With the exception of Mr. W. Vernon, electrician, who represented Dulwich in the Labour interest in the last Parliament, all the "electrical" ex-members were re-elected. They include Sir Peter Bennett (C. Birmingham, Edgbaston), chairman of Joseph Lucas, Ltd.; Mr. T. F. Cook (Lab. Dundee East), member of the Electrical Trades Union; Mr. F. J. Erroll (C. Altrincham and Sale), a director of electrical companies and contributor of "Industry and the House" to the *Electrical Review*; Sir Arnold Gridley (C. Stockport South), chairman and joint managing director of Mawdsleys, Ltd.; the Hon. J. Grimston (C. St. Albans), a director of Enfield Rolling Mills, Ltd., etc.; Mr. C. R. Hobson (Lab. Keighley), power station engineer and formerly Assistant Postmaster-General; the Rt. Hon. Oliver Lyttelton (C. Aldershot), chairman, Associated Electrical Industries, Ltd.; Mr. Charles I. Orr-Ewing (C. Hendon North), commercial adviser (technical) to A. C. Cossor, Ltd.; and Mr. R. R. Stokes (Lab. Ipswich), former chairman and managing director, Ransomes & Rapier, Ltd.

Among the appointments in the new Government headed by Mr. Winston Churchill are :—

Secretary of State for Foreign Affairs and Deputy Prime Minister, Rt. Hon. Anthony Eden; Lord President of the Council, Lord Woolton; Lord Privy Seal, the Marquess of Salisbury; Secretary of State for the Home Department and Minister for Welsh Affairs, Sir David Maxwell Fyfe; Chancellor of the Exchequer, the Rt. Hon. R. A. Butler; Secretary of State for Commonwealth Relations, General Lord Ismay; Minister of Labour and National Service, Sir Walter Monckton, K.C.; Secretary of State for the Colonies, the Rt. Hon. Oliver Lyttelton; Secretary of State for Co-ordination of Transport, Fuel and Power, Lord Leathers; Minister of Health, Capt. Harry Crookshank; Minister of Housing and Local Government, Mr. Harold Macmillan; Secretary of State for Scotland, Mr. James Stuart, K.C. Lord Leathers will exercise general supervision over the separate departments dealing with Civil Aviation, Transport and Fuel and Power.

Mr. C. I. Orr-Ewing

Mr. J. Grimston



Mr. C. R. Hobson

Mr. T. F. Cook

Power Transmission

The Application of Measurement Technique

THE important part which measurement plays in the design and operation of the modern transmission system was emphasized by Mr. F. J. Lane (British Electricity Authority) last week in his inaugural address as chairman of the Measurements Section of the Institution of Electrical Engineers.

He said that the design and construction of any engineering project required a combination of experience, technical understanding and inspiration. While contributing to experience and providing the material for inspiration, measurement was the real foundation for technical understanding. In relation to the power transmission system, it could be subdivided into research, design, operation and planning. Research was directed to determining the properties of the materials to be employed, to prescribing the mathematical and mental processes by which one learned to proceed from the small effect to the great, and, by correlation of data, to assisting in the solution of special problems.

Contributions to Research

Since a separate address would be necessary to do justice to research, Mr. Lane thought it sufficient to remind his audience of such investigations as those on the effect of atmospheric conditions on insulators and overhead-line conductors, the measurement of corona levels and radio interference, the determination of the characteristic impedances and losses of lines and cables, and the exploration of the noise problem in transformers, to indicate the contribution that had been and was being made by research towards the achievement of the present high standard of security in supply channels.

With regard to measurement in design, there were three classes of tests which were generally recognized as necessary: type tests to prove the design, and routine and sample tests to check uniformity of production. Routine and sample tests presented no serious difficulty, but type tests were much more subject to discussion as the methods for obtaining data often did not correspond sufficiently closely to service conditions.

Since impulse testing was introduced there had been a progressive reduction of impulse levels mainly because of service experience. Experience alone was not enough, but the collection of reliable data might be amply repaid by economies in plant design.

Short-circuit Calculations

The short-circuit testing of circuit breakers was a fundamental part of the process of developing new designs. Short-circuit duties were not difficult to calculate, but there was little factual information about the conditions experienced in service. Some such data could be obtained from the high-speed ammeters now being included in every 132 kV transformer neutral, and the wider installation of Masson perturbographs should permit of further analysis. The procedure in the testing station provided designers with a detailed picture of circuit breaker performance, but carefully organized tests on the supply system would add appreciably to the knowledge of the factors involved and should lead to more efficient designs.

Referring to the functions of measurement equipment on transmission system operation, Mr. Lane said that the latest practice with transformers suggested that temperature was a better guide than current.

Many measurements and measuring devices made their contribution to the modern transmission system, and much progress had been made in the past on the basis of experience and new experiment. The increasing scale of the problems of electricity supply, however, must continue to demand greater and greater precision in the design of equipment, the utilization of materials, and the employment of technical manpower. Greater precision could only be obtained with a foundation of accurate information with regard to the conditions to which equipment might be subjected.

SOUTH AFRICAN NEWS

From Our Cape Town Correspondent

BY July next year it is hoped that the first stage of the plan by South African Railways to convert the Cape Peninsula's overhead power line from 1,500 V to 3,000 V operation will be completed, including the line from Cape Town to Salt River, from Salt River along the Cape Flats line to the junction at Heathfield and along the main line as far as Bellville. The southern suburban line from Cape Town to Simonstown will then be dealt with. The new power system is expected to speed up and improve the running of both suburban and main line trains.

When laying the foundation stone of the new £11,000,000 Vierfontein power station, which will supply the Orange Free State goldfields, the Minister of Economic Affairs promised that more electricity would be brought to the rural areas as soon as the supply position improved. He said a further power station would be built by the Electricity Supply Commission at Taaibos, near Coalbrook, O.F.S., to supply the oil-from-coal plant there. The Vierfontein power station, which would be one of the biggest in the Union, would supply enough power not only for the goldfields but also for industries and towns. It was hoped to have the first generators operating by December next year. As in the case of the Witbank, Klip and Vaal power stations, Vierfontein was being built on a coalfield and the fuel would be conveyed from the mine direct into the bunkers at the station. The coal found in this part of the Orange Free State was mostly of the low-grade variety for which there had been little use up to now. The presence of almost unlimited quantities of this coal had been taken advantage of in the design of the station, which would produce power at a cost which would offset the increased prices of electrical plant, and would compare favourably with production at other Electricity Supply Commission stations.

The Minister went on to refer to the Electricity Amendment Act of 1947 which, he said, would make a greater supply of power to the rural areas possible as soon as the position improved. It empowered the Minister to recommend that the Commission should investigate particular projects and he could then study the report and could direct the Commission to supply power on an uneconomic basis, assisted by funds voted by Parliament.

The electrical engineering division of the Bureau of Standards is subdivided into general electrical engineering, electrical appliances, battery testing and meter testing sections. The general electrical section is concerned with the testing of cables, insulators, insulating materials, motors, switchgear and circuit breakers. Numerous tests on porcelain insulators and bushings, rubber, p.v.c. and paper insulated cables, miniature circuit breakers, fuses, lightning arrestors and motor-car generators are carried out at the request of the manufacturers and the users of such equipment. Suitable permanent testing equipment for high voltage work up to 200 kV will be installed this year.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Awkward Apparatus

IT seems strange in this modern era that manufacturers still do not take into account the difficulties associated in connecting up their apparatus. I have just been examining some 100 A and 150 A t.p. and n. switch-fuses of reputable manufacture and feel quite sure that if the manufacturers and designers were given the job of connecting up their products, they would at once change their ideas.

Personally, I do not expect an electrician to be a contortionist and almost wonder if the manufacturers are aware of the correct diameter of the necessary conductors.

Glasgow. ALEX MILNE, SENR.

P.S.—My firm is at present carrying out a job of some magnitude in the Highlands where the apparatus is being used. Mr. Milne, Jnr. is supervising the work, but I cannot write his remarks.

An Unwanted Position

MY company recently advertised for a foreman winder for our associated motor factory in Calcutta. The salary offered was £1,500 per annum, plus certain allowances and arranged accommodation.

Not one satisfactory reply has been received. Is the old British pioneering spirit dead? Alternatively, what is the matter with the job?

Birmingham. E. W. WALKER, *Director.*

An Impulse Generator

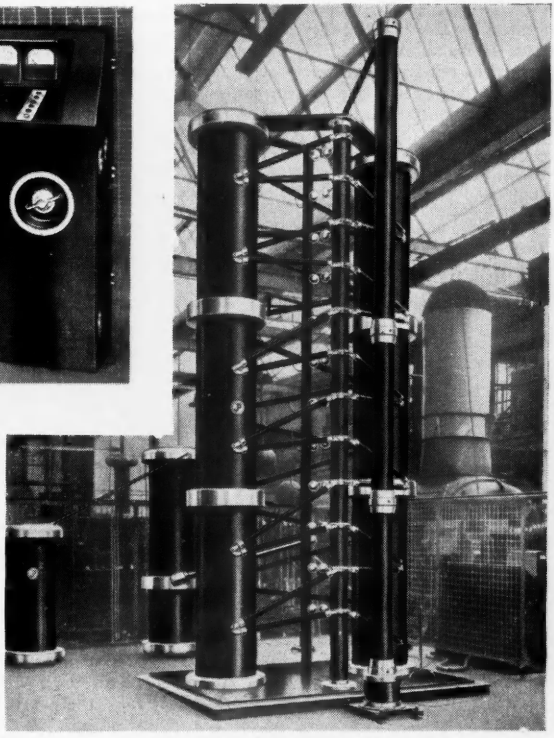
1,700 *kV Installation at Charlton*

FOR investigating the surge-voltage characteristics of electrical apparatus and insulation as well as for the routine impulse testing of such commercial products as transformers, cables, switchgear, sealing ends, bushings, etc., a 1,700 kV 30 kW-sec impulse generator has been designed and manufactured by Johnson & Phillips, Ltd., and installed as part of their h.v. test plant. It is believed that this is the only impulse generator of this class in Britain to have been designed and built entirely by one manufacturer.

For uniformity of appearance, the transformer, the rectifier and the generator capacitors are housed in 23in diameter black Bakelized paper tanks, fitted with cast aluminium end-rings and corona shields.

The d.c. charging unit consists of a 200 kV 6·6 kVA transformer, a 250 kV (peak) half-wave rectifier and a limiting resistor. The 230 V input is fed through a 0–250 V regulator to the primary of the transformer, designed and manufactured by the J. & P. Transformer Department, which has a tertiary winding for cascade operation and the core is at 100 kV. It is

Control desk in safety cage alongside the wire-screened testing area, all doors being interlocked with trip gear to prevent entry without the generator being de-energized and earthed



Impulse generator of 1,700 kV and 30 kW-sec of J. & P. design and manufacture installed in the high voltage test bay at the Charlton factory

housed in a black Bakelite oil-tight tank and the output terminal is the top corona shield, which is connected directly to the rectifier.

The copper oxide rectifier is mounted on an insulated base so that positive or negative d.c. may be obtained by connecting the transformer output to the bottom or top of the rectifier, the opposite end of which is connected through the limiting resistor to the first capacitor of the generator. The resistor passes a maximum of 30 mA at full voltage; at its output end is a solenoid operated switch, which automatically earths the generator when the transformer is de-energized, either from the control desk or by the opening of any of the interlocked safety gates of the test area.

The impulse generator consists of twelve stages, one capacitor per stage, arranged in two columns of three tanks, each tank containing two capacitors. Each of the latter, which were designed and manufactured by the J. & P. Capacitor Department, is rated at 0·255 μF and may be charged to 142 kV maximum.

With the twelve stages in series the maximum output of the generator is 1,700 kV and the total energy output is 30 kW-sec. The capacitors are discharged by means of twelve pairs of 10 cm spheres fitted on two vertical Bakelite cylinders

Assembly of one of the twelve capacitors, each comprising 198 flat elements

situated between the capacitor columns. One cylinder is fixed and the other may be rotated about its vertical axis by a lever arm and screw mechanism driven by a small electric motor accommodated under the base cover plates of the generator. A slide wire potentiometer, operated by the lever arm, gives an indication on the control desk of the gap setting. Adjustment of the gap is by push-button switches on the control desk.

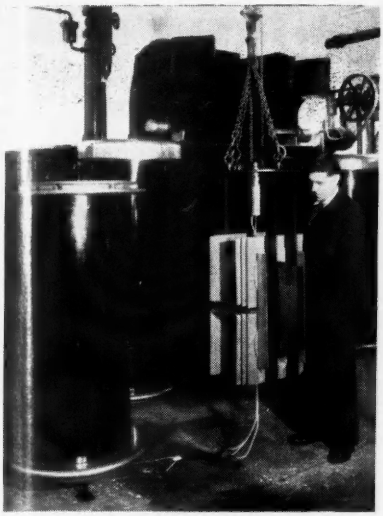
The output from the final stage of the generator is taken, through a damping resistor, to the potential divider and thence to the object being tested. Sets of resistors in each stage control the output waveform and these resistors may be replaced by others of different values to suit the various load conditions.

The overall height of the whole generator is 18ft, representing a figure of 10·6ft/MV, making it more compact than usual for its rating.

The potential divider is of the simple resistance type surrounded by a tube of cylindrical capacitors which screen the resistors and at the same time put a small load on the generator, thus reducing the effect on the output waveform of variations in test load. From the foot of the divider the surge is fed through a delay cable to the deflection plates of an oscillograph.

The latter is a high speed cathode-ray instrument of the sealed glass-tube type, working at 20 kV accelerating voltage. It incorporates two beams for the simultaneous recording of voltage and current surges. Sweep speeds from 0·3 to 1,000 μsec are available together with timing "pips" covering a range of time intervals from 0·1 to 100 μsec. For voltage measurement, fixed calibrating voltages are are provided. Initiation of sweeps and brightening pulses is effected by a valve relay operated at the instant of "firing" the first-stage gap. A 33 mm recording camera is used in conjunction with the oscillograph for obtaining permanent oscillographic records of all tests.

To enable the operator or customers' representative to monitor tests which are being photographically recorded, a single beam (10 kV) high speed oscillograph is being provided by the J. & P. Instrument Department, which has already manufactured a recurrent surge oscillograph for the investigation of transformer windings.



Core and windings of energizing transformer ready for insertion in tank

The generator is operated from a control desk outside the wire-caged test area. The desk, designed and manufactured by the J. & P. Switchgear Department, houses the voltage regulator, the push-button switches and associated contactors for energizing the 200 kV charging transformer, and the push-button switches for adjustment of the generator sphere gaps. Indication is given by meters on the desk of the voltage and current inputs to the charging transformer, the gap setting and the mean stage voltage. The last-mentioned is indicated on a micro-ammeter connected through a 3,000 megohm resistor to the high voltage side of the first stage capacitor, the micro-ammeter being scaled in kilovolts.

The three-electrode method of controlling generator tripping is not used, although provision has been made for its addition at a later date. For single surges the stages are charged to the required voltage and the gaps are then closed until discharge occurs. For repetition shots at a constant voltage the generator is allowed to charge continuously with the gaps set for flashover at the required discharge voltage. For chopped waves, as required in transformer tests, a standard rod gap for up to 750 kV is connected in parallel with the generator.

The equipment is at present installed at one end of the production test bay at the Charlton works, pending the issue of a building licence for a separate laboratory in which to accommodate the impulse generator.

I.E.E. Benevolence

THE annual report of the Court of Governors of the Incorporated Benevolent Fund of the Institution of Electrical Engineers for the year ended June, 1951, shows that the capital has appreciated to £126,354, while the income for the year from all sources amounted to £17,928. Subscriptions and donations reached £15,057, an increase of £1,805, but the number of contributions unfortunately decreased by 95 compared with the previous year.

Grants were made to 115 persons; in assisting those beneficiaries the Fund also gave support to 91 of their dependants. Those grants amounted to £7,777, the average amount distributed during the year being £68 per beneficiary.

The personal appeal to annual subscribers made a year ago resulted in an additional 600 members completing deeds of covenant, enabling the fund to recover income tax, thus raising the number of contributors under this plan to more than 1,500.

Deeds of covenant have been signed by more than 340 members for subscriptions to the Homes Fund which, together with other amounts, now aggregates more than £38,700. Grants totalling £104 were made from the Wilde Fund and £280 from the Lord Hirst Fund during the year.

Consulting Engineers

THE annual report on the activities of the Association of Consulting Engineers during the year ended April, 1951, records the admission of 34 new members, raising the total to 327. Requests were received for 88 nominations for the services of consulting engineers from Government Departments, local authorities, commercial firms and other clients. Nominations were spread over 103 different town and country member firms.

Some time must elapse before the contemplated revision of model forms of agreement for work undertaken can be completed. Negotiations were also carried on with Government Departments concerning professional rules and practice.

A complete redraft of the articles of association is under discussion. The proposal to form a South African Society of Consulting Engineers has not yet assumed definite shape.

Manufacture in Brazil

From Our Rio Correspondent

ALTHOUGH Brazilian manufacture of electrical materials is expanding in the Federal District and Minas Geraes, the industry is still largely concentrated in S. Paulo. National Carbon do Brasil, affiliated to the Union Carbide and Carbon Corporation, was founded in that State in 1949, with a mixed Brazilian and American capital of £1,000,000, and is now beginning to make dry cells and batteries.

Ray-O-Vac International, Inc., of Madison, Wisconsin, has formed a Brazilian subsidiary, Brasusa S.A., and is making dry cells in S. Paulo. Large-scale production will start on the arrival of additional plant, and will include patent sealed-in steel dry cells. Both factories will use local raw materials almost exclusively.

Refrigerators

General Motors of Brazil have invested over £500,000 in S. Paulo to build domestic refrigerators. Production, now at the rate of 7,000 refrigerators annually, will be raised to 20,000 in 1952. Eighty local firms supply 72 per cent of the materials used in the factory. A Brazilian firm is also making domestic refrigerators of 7 cu ft capacity, the sale price being about 20 per cent lower than that of the imported article.

The Federal Council of Foreign Trade reports that more than ten firms are making transformers in Brazil, of types up to 2,500 kVA 44 kV.

Electric motors up to 75 h.p. are being made in large numbers in S. Paulo, both for industrial and domestic use. For these steel, ball bearings and copper are imported. Several firms are making resistances, measuring instruments, switches, stoves, heaters, fans, floor polishers and other domestic apparatus, radio and television receiving sets and radio transmitters. The S. Paulo Syndicate of Electrical Manufacturers has recently protested against the issue of licences to import electrical apparatus for household use, alleging that local production exceeds requirements.

Miscellaneous Manufactures

An Austrian firm has applied for licence to construct a factory to build diesel-electric plant in Brazil, and the Italian manufacturers, D.I.S.A., have asked for permits to import industrial plant. Three American, two Swiss and one Brazilian firms are building elevators. D.c. motors, ball bearings, steel cables and certain special metals are imported, but the remainder of the requirements, including a.c. motors, are produced locally. The Brazilian company, whose output averages 400 units annually, representing 62 per cent of local production, is importing machinery to raise capacity.

The Mazda factory of the American General Electric Company produces 20,000 lamps daily, ranging from 15 to 200 W, and has begun making flash bulbs for photography. The factory, inaugurated in 1921, occupies an area of 70 acres, makes fluorescent lamps and a wide range of electrical apparatus.

Lighting, power and telephone cables and wires are manufactured in Brazil in sufficient quantities to cover local requirements and leave a margin for export. Production embraces a wide range of indoor, overhead, underground and underwater cables and wires. The value of S. Paulo's monthly output is calculated at £500,000.

Imports

In spite of industrial expansion Brazil's imports of electrical materials are increasing. During the first four months of 1951 imports included: refrigerators, £2,281,780; elevators, £184,620; radio valves and parts, £2,533,780; generators and motors, £2,594,520; apparatus for electrical installations, £815,840; and static transformers, £757,380. Full details of imports from Great Britain are not available, but during the second six months of the Anglo-Brazilian Agreement, which expired on 30th June, Brazil imported British electrical equipment to the value of £1,158,000; refrigerators, £856,223; and dynamos and motors, £640,097.

DISTRIBUTION IN FACTORIES

SOME aspects of electrical distribution in factories were discussed by Mr. E. Jacks (English Electric Co., Ltd.) recently in a paper presented before the Manchester Association of Engineers. Generally speaking, the paper was confined to the consideration of distribution equipment with particular reference to the application of modern h.r.c. fuses, but it was emphasized that these should be considered in relation to all the other equipment, such as fittings, motors and other consuming devices which comprised the modern factory installation. The paper therefore consisted of an objective examination of the basic principles of electrical distribution followed by a discussion concerning the choice of equipment and concluding with a consideration of some of the problems affecting a number of specific industries.

Commerce and Industry

Cable Makers' Wage Increase

Domestic Cooker Production

AT a meeting held on 17th October the Joint Industrial Council for the Electrical Cable Making Industry referred to its Negotiating Committee the application of the trades unions for an increase in wages to employees engaged upon work coming within the Classifications of Occupations, Schedule 1. At a meeting on 24th October the Committee unanimously agreed that advances be granted to all adult workers of 10s 1d per week of 44 hours in respect of adult male employees, and 8s 3d per week of 44 hours in respect of adult female employees. Proportionate advances are granted to male and female employees under adult age.

It was also decided (a) that the formula relating to payment by results systems agreed by the Council on 31st January last be maintained, it being understood that the "standard time-working rate" referred to therein shall be the new time workers' rate as now established, inclusive of the foregoing advances; (b) that the fall back rate for payment by results workers shall be the appropriate time workers' rate; (c) that payment by results workers shall not receive enhanced bonus earnings as a consequence of the foregoing straight advances, apart from any adjustments which may be necessary to payment by results systems applied to direct production workers in order to conform with the formula of 31st January, 1951, as qualified in (a) above; and (d) that the foregoing advances shall become effective on the third pay day in November in respect of the period for which payment is made on that day.

Aerodrome Equipment

In the accompanying picture we show a consignment of control gear leaving the Bradford works of the Airedale Electrical & Manufacturing Co., Ltd., for an aerodrome in this country. The cubicles house control gear ranging from a 1,000 A oil circuit breaker which controls the incoming supply to a direct-on-line starter for a 25 h.p. motor. Apart from the main oil circuit breaker, all the equipment is automatic, covering both squirrel cage and slip-ring motors. The weight is approximately three tons.

Control gear for an aerodrome leaving the Airedale Electrical & Manufacturing Co.'s works

Power Engineers' Salary Increase

By an agreement recently reached power engineers employed by the British Electricity Authority and Area Boards are to receive increases in salary as follows:—10 per cent on the first £450; 4 per cent on the next £350; and 2 per cent on the balance. Incremental grades under Clause 35 of the National Joint Board agreement for junior engineers do not receive the addition but it is applied in the final grade of each class. Junior engineers' salaries in Schedule "C" are not increased, but employees so graded at 31st July last are to receive an added year's seniority.

B.E.A.M.A. Domestic Cooker Section

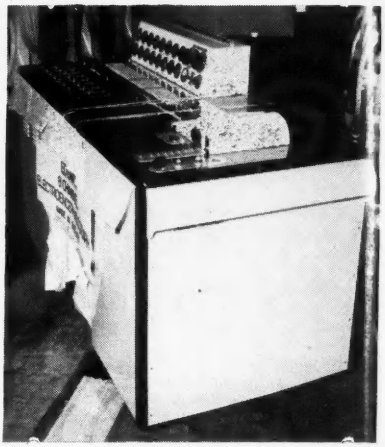
At the recent fourth annual dinner of the Domestic Electric Cooker Section of the British Electrical and Allied Manufacturers' Association held at the Trocadero Restaurant, London, Mr. Percy Tonks, chairman, occupied the chair. The toast of the Section was proposed by Col. B. H. Leeson, director, B.E.A.M.A., who referred to the very difficult times the industry as a whole, and in particular the light side, was encountering, and the need to take firm steps to deal with the situation.

In his reply, Mr. Percy Tonks said that in spite of the demands of the defence programme and consequent grave shortage of essential raw materials, the home sales of cookers had remained steady and production had been maintained: electric cookers had become increasingly prominent among our exports of electrical

equipment. A cordial relationship with the B.E.A. and Area Boards had been established and he felt the cooker manufacturers could rely on the sympathy, if not the active support, of the supply side in many of the problems which they had to face. He was confident that once the immediate difficulties beyond the manufacturers' control had eased the industry would expand and prosper.

Electro-Medical Plant for Sweden

An electro-encephalograph made by the Edison Swan Electric Co., Ltd., was recently dispatched to Oslo by air, by the Scandinavian Airlines System. Part of the seating accommodation of the airliner was removed to enable the instrument to be stowed in the passenger cabin. This is the first Ediswan instrument of this kind to be dispatched by air, but the economies in packing and transport time, coupled with the reduced vibration, are such that this form of transport will be increasingly used for future dispatches. The accompanying picture shows the electro-encephalograph on board the airliner.



An Ediswan electro-encephalograph being dispatched by air to Oslo

Export Inquiry

A firm in Quito, Ecuador, has asked us to put it into touch with manufacturers interested in granting agencies for the distribution of motors and electrical equipment, especially for small industrial undertakings. Communications from interested manufacturers will be forwarded.

Christmas Lights

"Mazda" fairy candles make an attractive complement to the fairy lights and "Cinderella Disneylights" produced by the British Thomson-Houston Co., Ltd., for Christmas decoration. The new fairy candles are easily clipped to the Christmas tree or to any type of horizontal rod. Each set contains twelve candles of various colours, ready wired and complete with clips.

The new "Mazda" fairy candles

Transformers at Poole

The article on the Poole generating station which the controller of the Southern Division, B.E.A., contributed to our issue of 28th September inadvertently omitted to mention the manufacturers of the transformers. The Fuller Electrical & Manufacturing Co., Ltd., built the 132 kV and main auxiliary transformers while those of lower voltage were made by the Hackbridge Electric Construction Co., Ltd.

Manchester Electrical Industries Ball

The annual ball in aid of the Electrical Industries Benevolent Association will be held on 7th December at the Midland Hotel, Manchester, from 7.15 p.m. to 1 a.m. (dinner at 8 p.m.). Music will be provided by the "Dorchesters" Dance Orchestra and the cabaret will include "Bayard and Marion." Applications for tickets (£2 5s each) and for table reservations should be made to Mr. C. Brookes, Salford Electrical Instruments, Ltd., Peel Works, Silk Street, Salford, 3.

B.B.C. Year Book

As usual the B.B.C. Year Book for 1952 (published by the B.B.C. at 3s 6d) is an interesting review of the Corporation's activities during the past year. It is introduced by the Director-General in an article, "The Fourth Decade," and there are sixteen other articles by well-known radio people. The latter half of the book contains much factual and statistical

information about the B.B.C.'s services, including the accounts for 1950–51. Television secures a fair share of mention and the volume is well illustrated.

Equipment for Imperial College

Specially constructed battery charging and control gear has recently been completed by Chloride Batteries, Ltd., at the Imperial College of Science, South Kensington, to provide d.c. supplies at various voltages for students working in the laboratory. A 110 V battery consisting of fifty-five Chloride HJG5 cells (300 Ah at the 10-hour rate) was retained from the original apparatus installed over twenty years ago and has now been re-erected in a more convenient position with a new "Cycloc" automatic constant voltage charger and a metalclad voltage selection/distribution panel.

The battery is tapped to give nominal voltages of 24, 48 and 110 V. Connected across each of the tapped sections is a "Cycloc" charger rated at 0 to 20 A at 2·3 V per cell and designed to maintain the output voltage at a constant level over a fixed range of current.

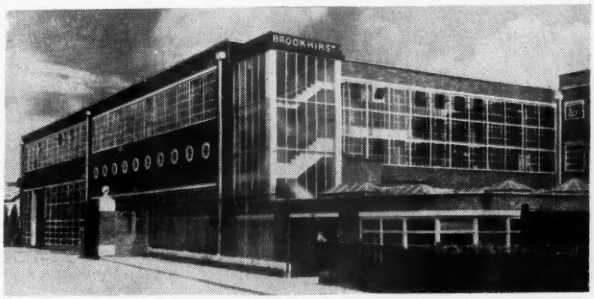
Since each section of the battery is connected across its own individual rectifier, the load under normal conditions of up to 20 A is supplied by that rectifier, while the cells, receiving their trickle charge at 2·3 V are maintained in a fully charged condition. Loads in excess of the maximum rectifier rating are automatically transferred to the battery. By means of plugs and sockets the voltage selection and distribution board makes any one of the three nominal voltages available at any or all of forty-seven laboratory bench positions.

The Building Centre

From 3rd December next the address of the Building Centre will be Store Street, Tottenham Court Road, London, W.C.1 (telephone: Museum 5400).

Brookhirst Jubilee

The completion of large works extensions has been used by Brookhirst Switchgear, Ltd., to mark its golden jubilee. Actually the company was founded rather more than fifty years ago by the late Mr. John A. Hirst, who was one of the pioneers of the motor control industry. At the opening of the Jubilee Building on 22nd October, the chairman of the company, Mr. J. O. Knowles, mentioned that the extensions represented an increase of about 45,000 sq ft in covered floor area and included extensions to assembly, test, and inspection departments, a new packing bay and warehouse, as well as a large social hall with kitchen, etc. Later, long service presentations were made to one hundred and thirty-six employees, each having not less than twenty-five years' service. Social events for employees in celebration of the jubilee lasted over five evenings, concluding with a carnival dance last Friday.



Jubilee Building, Brookhirst Works

Glover's Blood Donors

A record effort in support of the National Blood Transfusion Service took place at the works of W. T. Glover & Co., Ltd., Trafford Park, when over a third of the staff and works employees, including the general manager, Mr. D. T. Hollingsworth, contributed their blood to the National Blood Bank. The works theatre was converted into a hospital and for three days two units of the Transfusion Service took over and during working hours some 300 donors gave of their blood.

Simplex Conference

The caption beneath the picture accompanying the note on the conference of branch managers of the Simplex Electric Co., Ltd., in our last week's issue was incorrect. It should have read, left to right, Messrs. J. D. Johnson, E. G. Plucknett and A. G. Jones.

Travellers' Benevolent Institution

The Annual Court of Governors of the Commercial Travellers' Benevolent Institution will be held at the Berners Hotel, Berners Street, London, W.1, on Friday, 28th December, at 12 noon.

Argentine Grain Elevator

At Buenos Aires recently the management of the Anglo-Argentine General Electric Co., Ltd., entertained representatives of the Argentine Ministry of Public Works, the Engineering

Section of the Argentine Army and representatives of the technical Press at the New Port grain elevator building in the city. The occasion was to mark the completion of the grain elevator for which the company supplied the electrical equipment. The elevator has a capacity of 150,000 tons and is claimed to be the largest in the world. A most important item of equipment is a control panel which shows in mimic diagram the complete layout of the machinery—from the point of intake to the shipping quays.

Prices of Materials

In the accompanying table we give the prices of the more important materials used in the electrical industry. The figures are those quoted on Monday last.

ALUMINIUM Ingots	ton £124 0s 0d
COPPER, H.C. Electro	ton £227 0s 0d
Fire Refined 99·7 per cent ..	ton £226 0s 0d
Fire Refined 99·2 per cent ..	ton £225 10s 0d
COPPER Tubes	lb 2s 2d
Sheet	ton £277 10s 0d
H.C. wire and strip	ton £254 0s 0d
LEAD, English	ton £176 10s 0d
Foreign	ton £175 0s 0d
MERCURY	flask £73 10s 0d
TIN	ton £1,020 0s 0d
ZINC, G.O.B. Foreign	ton £190 0s 0d
Electrolytic	ton £194 0s 0d
BRASS Tubes	lb 2s 1d
Sheet	lb 2s 4½d
Wire	lb 2s 7½d
PHOSPHOR BRONZE	
Wire	lb 3s 6¾d
RUBBER, No. 1 R.S.S. spot ..	lb 45½d–46d

Agricultural Engineering

In the report of Mr. F. E. Rowland's address before the Institution of British Agricultural Engineers on page 852 of last week's issue it was incorrectly stated that the annual production of the agricultural industry was valued at £1 million. This figure should have been £100 million.

Catalogues and Lists

Midland Dynamo Co., Ltd., Belgrave Gate, Leicester.—Illustrated folder on "Quickway" armature and coil winding and forming equipment.

New Fortuna Machine Co., Ltd., Fortuna Works, Southmead, Bristol.—Two folders on machines for hack sawing, skiving, strap and lace cutting, rolling and cementing and solutioning.

Simplex Electric Co., Ltd., Broadwell, Oldbury, Birmingham.—Illustrated catalogue of switch and fuse gear.

Works Visit

About thirty members of the Institute of Metals paid a visit to the Greenwich Works of the Telegraph Construction & Maintenance Co., Ltd., on 18th October. Led by Dr. F. A. Fox (H. J. Enthoven & Sons, Ltd), they were received by Mr. W. F. Randall (director, T. C. & M. Co., Ltd.), Mr. F. Leighton (works manager), Mr. R. F. Harvey (general sales manager), Dr. G. A. V. Sowter (manager, metals division), Mr. C. M. Roberts (manager, copper department), and Mr. F. S. H. Lemon (manager, submarine cable factory). Luncheon and tea were served in the canteen.

Window Display Contest

Particulars have been circulated by Hoover, Ltd., to all Hoover dealers of an autumn window display contest of the company's products. There are three classes covering Electricity Board showrooms, departmental stores and home furnishers, and electrical contractors and ironmongers, and prizes totalling 300 guineas are offered, in addition to a special challenge cup for the best display. After the prizes in the national contest have been awarded, the remaining entries will be judged again and prizes of 15 guineas each awarded for the best in each category.

Trade Announcement

Dowding & Mills, Ltd., have opened a branch office at 24-26, Whitepost Lane, Hackney, London, E.9 (telephone: Amherst 3119), and works at 21-23, Rothbury Road, Hackney, E.9. The manager is Mr. H. Wharmby.

Gypsum Winning

In the article on this subject in our issue of 8th June reference was made (page 1178) to the main ventilation system at the Gypsum Mines, Ltd., and the "50 h.p. G.E.C. motor driven propeller-type fan" installed for the system. This fan, in fact, is a Keith Blackman 60in high-efficiency axial fan driven by a G.E.C. motor. The fan handles 60,000 cu ft of air per minute at 3·4in w.g.

Information Department

THE extensive records of our Information Department enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the makers of the following:—

"Golden Glow" heaters.

"Delta" electric handlamps.

General inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by the Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Electrical Opportunities

I.E.E. Utilization Section Chairman's Address

As the theme of his address as chairman of the Utilization Section of the Institution of Electrical Engineers, Mr. A. H. Young (Edmundsons Electric Co., Ltd.) took problems and opportunities in production and utilization of electricity. Improvement in efficiency in both was indicated by a consumption 430 times that in 1900, gas during the half-century having increased nearly nine-fold, whereas the coal mined was about 10 per cent less.

This country, he said, was not the only one faced with a decline in coal production, but many countries had other national resources and ultimately parallel means must be found here, e.g. coal gasification, oil, or nuclear fission. In the meantime there would be great opportunities for engineers in solving the more immediate problem of efficient use of electrical energy, to which, on account of the rapid growth of the industry, too little regard had been paid, especially in coping with peak loads on supply systems. The load factor of industry averaged only about 20 to 25 per cent, but the high diversity of the domestic load helped considerably in raising the overall system load factor to about 46 per cent.

Load Factor Improvement

Sir Henry Self had recently estimated that the contribution to the peak of this domestic load was about one-third compared with two-thirds by industrial and commercial loads. The need to improve industrial load factor, having regard to its own large capital investment, could be met by staggering hours. Generating stations were fully loaded for comparatively short periods and there would be no need for load shedding if a portion of industry could be persuaded to take its requirements during lightly loaded periods.

There should be a co-ordinated policy for fuel resources which must not restrict development but should continue the low-price principle so as to maintain a high load factor. Generating units installed in industrial premises should be utilized to the fullest capacity in parallel with the public supply. The possibilities of district heating should be considered when siting new power stations and greater use should be made of waste heat for industrial purposes by siting new factories near existing power stations.

Electricity contributed very largely to the increase of 30 per cent in the volume of industrial production between 1947 and 1950, but to equal the position in the United States (where each worker used 6 electrical h.p. against 2 in Great Britain) 13 million h.p. would be required. Railway electrification would save nearly as much coal as was now used in the production of electricity for domestic consumption and would also offer scope for the manufacture of improved traction equipment for export.

The Fuel Problem

Sir Claude Gibb had suggested that all coal should be processed and the surplus by-products exported. Failing some such approach, which would involve heavy capital expenditure, Mr. Young submitted that present views on the utilization of electricity would have to be modified. During the next ten years or less the kWh generated would be doubled (50 per cent being used domestically), entailing the consumption of 60 million tons of coal, which would have to be raised and transported.

The invention of a light-weight accumulator capable of being charged at a high rate in a short period would go a long way towards levelling the load curve and could also be used extensively in transport to save imported fuel. The recent development of new liquids as heating media for operation at up to 600 deg F without pressure might enable electrical energy to be stored as heat during periods of low demand.

About one-third of the coal consumed in Great Britain was used directly or indirectly

for domestic purposes and he hoped that a paper would soon be read before the Utilization Section outlining the problems involved, so as to stimulate more aggressive thought and action. A fundamental difficulty was that many buildings were designed for heating by coal at a low price which was now a thing of the past. Greater use should be made of thermal insulation and more modern efficient heating apparatus, of the type selected by the occupier, should be installed. The inexpensive and useful portable electric fire when used during peak hours entailed a capital cost to the supply authority of over £100/kW.

Space Heating

The solution of the electric space heating problem did not, he suggested, lie in restriction by load limiting or other devices, but in the development of a heating medium with low-wattage elements as a base-load in conjunction or alternating with modern slow-combustion anthracite stoves. Investigation of new chemicals also appeared worth while, but this would also involve the development of new utilization apparatus.

Engineers could not make plans for the more efficient use of fuel resources without adequate financial support, but during the past 50 years the effect of increasing taxation had left a diminishing amount of "risk capital." Economies in generation (e.g., the annual reduction in coal consumption of 140,000 tons for each 0·1 per cent improvement in thermal efficiency) were often dissipated through excessive losses in distribution or faulty utilization. Losses in transmission and distribution reached 13 per cent of the total energy sold to consumers, equivalent to 412 kWh each.

Insufficient regard was generally paid to the loading of small transformers in rural areas. Iron losses and energy losses per annum for 5 to 25 kVA standard units amounted to: 5 kVA rating, 72 W and 630 kWh; 10 kVA, 104 W and 915 kWh; 15 kVA, 132 W and 1,155 kWh; 25 kVA, 180 W and 1,580 kWh. These losses could be reduced if cold-rolled sheet steel were more readily available. Many rural dwellers did not use 630 kWh a year and for every useful kWh two might have to be supplied to a 5 kVA transformer. Therefore these consumers could be uneconomic even if they paid the cost of connection, on which also depreciation would be high. At present only about 1 per cent of the total output of electricity in this country was used by agriculture—an insignificant amount in relation to the capital and output of the agricultural industry. Special electrical apparatus had been designed for farmers, but comprehensive rural electrification still offered great opportunities. Greater electrification would indirectly stimulate an expanding market for a wide range of machinery, goods and services. One kWh, properly applied, could replace ten hours of human energy, i.e., one pennyworth of electricity would be equivalent to 20s–30s in human effort.

Competition had stimulated development in gas and solid fuel appliances during the past fifteen years and should do as much to create new ideas for the more economic use of electricity. The electrical industry in this country owed much to the foresight and initiative of individuals working in comparatively small units. The modern large units, although having research facilities denied to the pioneers, tended to produce numerous specialists, but few men with the wide range of practical experience and consequent appreciation of the problems and opportunities which were common under the old type of organization. It was to be hoped that leading industrialists and others in greater numbers would use the Institution facilities for a frank discussion of problems and possible solutions, as our very existence depended on the development of new techniques in the production and utilization of electricity.

Scottish Contracts

LAST week the North of Scotland Hydro-Electric Board denied allegations made by Mr. A. K. Stables, Scottish contractor, that the present system of allocation of Board work operated unfairly against Scottish firms. Mr. Stables alleged that contracts were controlled and administered by London consultants. The Board stated that it employed twelve firms of consulting engineers; seven were Scottish and five had headquarters in London, but these five, according to the Board, had opened offices in Scotland. Dealing with Mr. Stables's complaint that most of the English contractors were working on the "cost-plus" system the Board replied that only 5 per cent of its contracts were on this basis, and its reasons for allocating work under cost-plus were adequate and justifiable in each case.

Dairy Show

Increasing Adoption of Electrical Methods

LOOKING back upon Dairy Shows of past years, it is evident that remarkable strides have been made in the application of electricity to farming. At the British Dairy Farmers' Association's sixty-fifth annual show at Olympia last week there was scarcely a stand on which electrical appliances were not to be seen and it was particularly striking to observe how the use of electricity, regarded as a novelty for some duties a few years ago, has now been adopted as essential wherever supplies are available.

Visitors were particularly reminded of the multitudinous applications of electricity on the Electrical Development Association's stand where there could be seen a replica of a portion of the grain silo and Dutch barn of the most completely equipped farm ever exhibited in the British Isles, namely that at the Ulster Farm and Factory Exhibition at Castlereagh, Belfast, this year. Four automatic film strip projectors showed examples of the use of electricity for milking, milk cooling, pumping water, sterilizing dairy utensils and grinding and crushing animal foodstuffs, and on the walls of the stand were layout details and data relating to the various applications of electricity in dairy farming.

The progress made in what may be described as the initial electrical service on

(1) Loheat "Chillchurn" milk cooler. (2) Kelvinator milk cooler. (3) Alfa-Laval cream separator

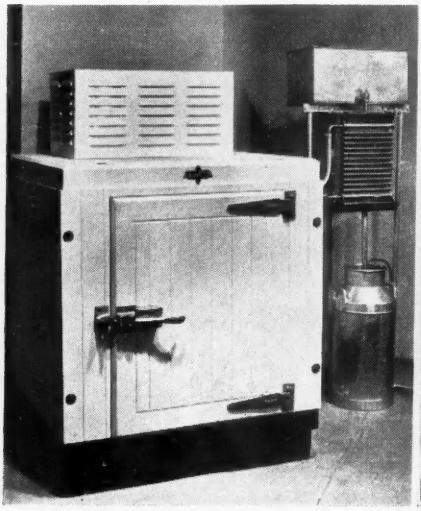
the dairy farm, milking, was effectively demonstrated on a special display arranged by the *Power Farmer* to illustrate the development of mechanical milking during the past century. Though there were plenty of fixed and portable bucket type machines on view on the stands of the individual manufacturers, there seems a tendency towards the recorder and recorder releaser types.

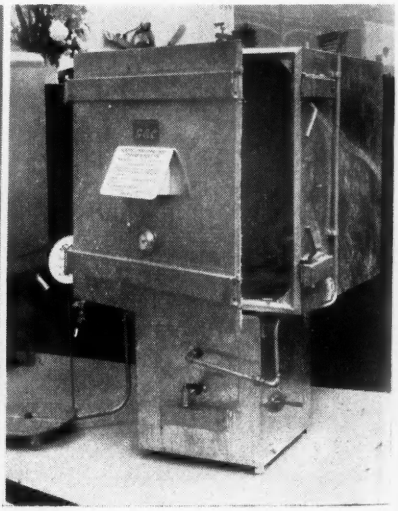
Probably the greatest developments recently so far as the dairy farmer is concerned are in the field of refrigeration. This is particularly true of the devising of economical equipment for milk cooling. The in-churn method, which has much to be said for it in regard to efficiency and the saving of labour, appears to be gaining in popularity. In addition to Gascoignes' " Rotor-Freeze " unit, which can also be used with existing vacuum or open coolers, a new apparatus made its first appearance, the Loheat " Chillchurn." The latter incorporates a $\frac{1}{2}$ h.p. motor and two pumps; it is fully automatic and will cool up to four churns at a time from 90 deg F to 50 deg F in under twenty minutes. The " Prestcold " four-churn unit is available with churn-lifting gear. The manual effort of lifting the churns is eliminated by a novel device incorporated in another new in-churn cooler, a three-churn model made by Purlac Equipment.

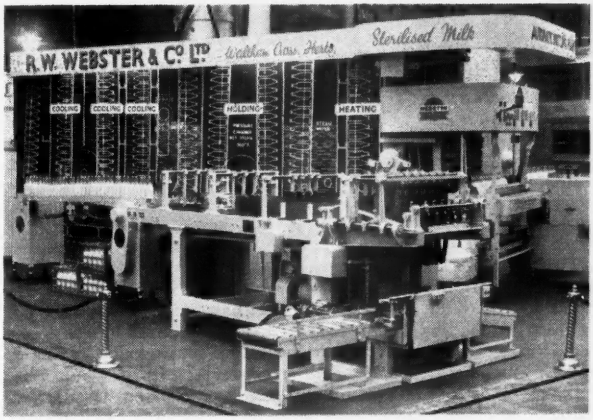
A new self-contained cooling unit complete with surface cooler introduced by Kelvinator, Ltd., is available in two sizes for handling 40 and 50 gall per milking. It has a copper tank and, being arranged vertically, takes up the minimum of floor space. Of somewhat similar design is the " Ellwood " ice-bank cabinet shown by Frigidaire, Ltd. The " Chillwell " chilled water cooler was exhibited by J. & E. Hall, Ltd., and Marco Refrigerators, Ltd., had on view a chilled water cooler and storage cabinet arranged as one unit. The latter apparatus cools 25 gall of milk an hour, twice a day, and has a storage capacity of two 10-gall churns.

There was a profusion of cold rooms, quick freezers, storage and display cabinets and ice-cream conservators, many of them making their first appearance. Especially comprehensive displays were arranged by the International Refrigerator Co., Ltd. (" Coldrator "), L. Sterne & Co., Ltd., and York Shipley, Ltd. A 15 cu ft service cabinet incorporating a frozen food compartment, a 15 cu ft model of the farm freezer, and a combined frozen food cabinet, ice cream conservator and service cabinet are new " Prestcold " products. A new 9in by 6in by 6in compound ammonia compressor made by J. Weir, Ltd., is suitable for ice cream and other types of hardening

Left: **Marco combined chilled water cooler and storage cabinet.** *Right:* **G.E.C. 27 cu ft unlagged storage block type sterilizing chest**







"Lilleshall-Webster" automatic crate packing machine

tunnels, quick freezing plants, ice cream freezers, etc., in which the compression ratio would be excessive for a single-stage machine.

The ice cream industry presents its own peculiar demands for special equipment and, besides normal refrigeration plant, calls for such items as heat treatment vats, homogenizers, emulsifiers, coolers, cold storage vats, freezers, hardening plant, lollipop plant, chocolate enrobers, brick cutters, wrappers and conservators. Among the many new items in this class we noticed the "AeroPhreze" lollipop freezer cabinet on the Frigidaire stand and a 4 cu ft ice cream and frozen food cabinet among the Kelvinator display.

To return to the subject of milk treatment, there was evidence of increasing dependence on electricity for controlling pasteurizing processes. Bottle washers, fillers, and cappers, suitable for the small producer-retailer as well as the large distributors handling thousands of gallons an hour, were demonstrated and a new item was R. W. Webster & Co.'s "Lilleshall-Webster" automatic crate packing machine dealing with 2,400 gall of milk an hour.

Among cream separators the Alfa-Laval Co., Ltd., demonstrated a new all-electric model with a direct belt driven high starting torque motor built in; it is available in 35, 55 and 75 gall/hr capacities. A combined separator and churn were shown by the Churn Co. Butter moulding and wrapping machines were also on view as well as equipment required in the manufacture of cheese.

Left: **Woolley "Lectrolid" potato steamer.** *Right:* **A display of infra-red heating lamps for poultry, etc., rearing shown by Clarbat, Ltd.**

Sterilizing is a process for which electricity is finding an increasingly ready application not only in the dairy but in the ice cream and other food industries. An especially interesting development seen on the stand of the General Electric Co., Ltd., is a 27 cu ft unlagged storage block type chest. Basically the same as the previous lagged model and loaded at 1 kW, it is ready for operation within 15 minutes of switching on. While reducing the cost considerably, the omission of the lagging adds

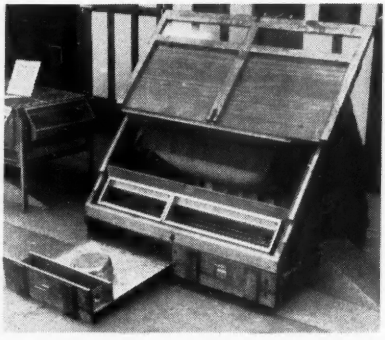
little to the working cost in view of the speed of operation.

For the dairy farm where a steam raiser is required, but where only relatively low electrical loadings are permissible, or where it is desired to offset the effect of power cuts, the G.E.C. exhibited one of a range of water storage steam raisers used principally for sterilizing the larger capacity recorder milking plants and for supplying hot water through a mixing valve, by steam injection.

Two storage-block steam raiser water heaters also meeting the above requirements were shown. The smaller model has an electrical loading of only 1 kW each for steam raiser and water heater and is suitable for sterilizing a small recorder milking plant or an existing sterilizing chest. The larger model, shown for the first time, is suitable for 4 to 6 point recorder plants and has a loading of 2 kW for the steam raiser and 2 or 3 kW (as required) for the water heater. The Alfa-Laval bucket heater is controlled by a mercury switch operated by the weight of the bucket and water.

The advantage of using some form of heating for pig farrowing is now generally realized. On the G.E.C. stand three alternative methods were demonstrated: reflector fires, infra-red heaters and low voltage floor warming. An installation employing floor warming could also be seen on the Loheat stand where it was pointed out that with electricity at 1d per kWh the running cost per pen for the whole eight weeks required would be approximately 17s, against which the saving in straw bedding should be considered.

Stephens "Glevum" warm floor brooder



Steaming of potatoes for pigs, etc., is carried out very economically in the new "Lectrolid" apparatus made by J. W. Woolley & Co., Ltd., manufacturers of the "Electrobloc" sterilizing equipment. As its name implies, the steamer has a pair of 1½ kW elements fitted in the lid, the container being turned upside down when in use. It has a capacity of 2 cwt, the steaming operation taking three hours. Fixed, mobile or trolley patterns are available. Curfew Appliances, Ltd., showed another type. Other food preparation equipment displayed included mills, cutters and choppers and a portable pneumatic grain conveyor was to be seen on the stand of Mitchell, Colman & Co., Ltd.

In the poultry section probably the most striking feature was the large selection of "cafeteria" type feeding and watering batteries, some of them incorporating automatic conveyors for the droppings. Most modern electric incubators have sufficient heat retention to enable them to withstand the effects of power cuts. A device used by the Secura Incubator Co., Ltd., to improve this quality further is the incorporation of an electric hot water system.

Infra-red heating of brooders has made considerable progress and among several manufacturers utilizing this method are George H. Elt, Ltd., Mayfair Incubators and Clarbat, Ltd., the last-mentioned company having a representative display of the various types of lamps available. Contrasted to this and the normal methods of electric heating was the Stephens "Glevum" warm floor brooder. Egg grading, poultry plucking and storing provided further indications of electricity's scope.

The delivery of milk and other dairy produce is a duty which can be efficiently performed by battery electric vehicles, examples of which were exhibited by Austin Crompton Parkinson Electric Vehicles, Ltd., Brush Coachwork, Ltd., Hindle Smart & Co., Ltd., the Lancaster Electrical Co., Sidney Hole's Electric Vehicles, Diamond Motors (Wolverhampton), Ltd., the Harborough Construction Co., Ltd., and Smith's Electric Vehicles, Ltd. Batteries for use in electric vehicles were shown by the D. P. Battery Co. and the Tudor Accumulator Co., Ltd., together with batteries for farm and country house lighting. R. A. Lister & Co., Ltd., included small generating sets in their display.

ELECTRICITY SUPPLY

"Shedding" Warnings in Scotland

Load Spreading in the North-East

APART from the national scheme by which the B.B.C. is to broadcast warnings of power cuts, the South West Scotland Electricity Board is introducing a scheme of its own. It is proposed to use short-wave radio transmissions for the purpose and it has been stated that the Board will install receivers, each costing about £120, in factories participating in the scheme and "really needing" a receiver. In reporting this matter the *Bulletin & Scots Pictorial* (Glasgow) says its representative was also told that at that time the Board had only 30 receivers. It was expected that 58 would be available by the end of October. "After that it is impossible to say when we shall get more, as they are extremely difficult to get. We have 1,700 industrial consumers so a lot will have to be disappointed."

Load Spreading

Arrangements have been made in the North Eastern Area by which, from Monday last, about 85 per cent of the workers in the area start work at noon on different days during the week and continue until 9.30 p.m. As a variant employees of other firms work from noon to 4 p.m. on one day a week and on Saturday mornings. Some others will work night shifts. In the Wearside shipyards endeavours are to be made to see that welding and other applications of electricity are carried out in off-peak hours.

Negotiations in the spinning section of the cotton textile industry broke down last week because of the employers' unwillingness to grant extra pay for work during unusual hours. Mr. S. Costello, a representative of the Operative Spinners' and Cardroom Amalgamations, said that his members were willing to co-operate in load spreading schemes, but to ensure success the employers should offer an incentive such as time and a quarter outside the usual working hours.

Mr. Henniker-Heaton, of the Federation of Master Cotton Spinners' Associations, said that such a payment would put electrically-driven mills in an even worse position than steam-driven mills; in any event they would suffer considerably from power cuts. He also said that at least 95 per cent of industry generally would be working rearranged hours without additional payments.

Temporary Malvern Hills Line

As a means of ensuring a supply to a part of Herefordshire the Ministry of Fuel and Power has sanctioned the erection of an overhead power line over the Malvern Hills. It stipulates, however, that the line is to be a temporary one only and must not remain for longer than twelve months.

Street Lighting Improvements

Three sections of the London to Bath trunk road in the Slough and Maidenhead districts have been equipped recently with mercury lighting, using G.E.C. lanterns of two types. At Castle Hill, Maidenhead, where the road

Section of the Bath Road at Slough lighted with 250 W mercury lamps in G.E.C. "cut-off" lanterns

width is 28ft, there are 44 " Viatron " lanterns, housing " Osram " 400 W mercury lamps, mounted on 25ft Concrete Utilities columns at a 120ft spacing. There is a further installation of 28 G.E.C. " Viatron " lanterns at Slough, and in addition a section of the road has been lighted with 250 W mercury lamps in 38 G.E.C. " cut-off " lanterns on Concrete Utilities columns with a spacing of 90ft, the width of the road being 30ft.

The Ministry of Transport has approved in principle stage three of GATESHEAD Town Council's street lighting electrification scheme. The cost of the work is over £26,000.

DARTFORD Highways Committee has approved a scheme submitted by the borough surveyor for street lighting in Burnham Road at an estimated cost of £2,240.

33 kV Lines Damaged

Following a supply failure affecting the Oxford outskirts, South Oxfordshire and North Berkshire on Sunday, Mr. J. L. Taylor, manager, Oxford District, Southern Electricity Board, stated that a length of steel wire had been thrown over two main 33 kV lines at Sandford-on-Thames. How those responsible had escaped with their lives was a miracle. Mr. Taylor said that the damage was the most serious they had had, though they had been troubled by gangs breaking insulators. When the steel wire touched the h.v. lines there was a loud explosion and the poles supporting the lines gave way so that the lines sagged over the roads and police had to stop all traffic. Engineers worked through the night to ensure an electricity supply to the Nuffield factories.

Lower Charges in Scotland

Householders in the Cowal district of Argyllshire and on the islands of Bute and Great Cumbrae are to pay less for their electricity. Because they are now supplied with power produced by the North of Scotland Hydro-Electric Board's new Cowal hydro-electric scheme, they are to go on to the Board's cheaper water power tariff. The new tariff becomes effective in these areas from the first meter reading after 29th October. The lower rates will not apply to the island of Arran where the supply will continue to be provided mainly from diesel generating plant.

Success of Illuminations

The number of people who paid to see Sunderland Town Council's six weeks' illuminations display at Roker this year was 467,894, an increase of 137,155 on last year. Receipts from admissions amounted to £11,697.

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to the dates stated:—

17th November

WAIR. No. B698,700. Class 9. Electrically-operated advertising signs, electric bells and buzzers, coin-freed automatic machines, electric cigar and cigarette lighters, electric vacuum cleaners, egg testers, door openers, flat irons, and weighing apparatus.—J. Lyons & Co., Ltd., Cadby Hall, London, W.14.

ISEP (design). No. 700,136. Class 9. Electric resistance wire made of tungsten or molybdenum; and borated copper wire being insulated electric wire.—P. R. Radeglia, 40, King William Street, London, E.C.4.

PHILCO. No. 663,866. Class 11. Refrigerators, air conditioning apparatus and heating apparatus (all sold complete), electric stoves and electric fans.—Philco Corporation, Philadelphia, U.S.A. Address for service, c/o Stevens, Langner, Parry & Rollinson, 5-9, Quality Court, Chancery Lane, London, W.C.2.

AEG (design). No. 693,121. Class 11. Incandescent lamps, arc lamps, mercury vapour lamps (not for medical or surgical purposes), furnaces (other than experimental furnaces), ovens, stoves, cookers, hot-plates for cooking, grillers, toasters, plate warmers, water heaters, boilers (not being parts of machines), fires, radiators, refrigerators, cooling machines, heating elements included in Class 11, and drying apparatus (not being machines), all being electric; and installations for lighting, lamp fittings included in Class 11 and electric ventilating installations. AEG (design). No. 693,122. Class 12. Electric locomotives, electrically driven railway carriages, electrically driven land vehicles, motor driven land craft and water craft; steam engines, steam turbines, gas turbines and internal combustion engines all for land vehicles; and electrically operated brakes for land vehicles.—Allgemeine Elektricitats-Gesellschaft, Berlin-Grunewald, Germany. Address for service, c o S. E. Matthews, 14-18, Holborn, London, E.C.1.

MULTITURB. No. 700,976. Class 11. Installations for lighting, heating, steam generating, cooking, refrigerating, drying, ventilating, water supply and sanitary purposes.—Lurgi Apparatebau-Gesellschaft m.b.H, Frankfurt-on-the-Main, Germany. Address for service, c/o W. H. A. Thiemann, 14-18, Holborn, Londor, E.C.1.

SWING. No. B968,408. Class 20. Electrically driven rotating turntables for the display of goods.—Stanley Rogers & Son, Ltd., 119, High Holborn, London, W.C.1.

24th November

SPURVIC. No. 701,126. Class 7. Electric alternators.—M. J. Tyssen and F. C. Cole, trading as Spurvic Manufacturing Co., 39, Victoria Street, London, S.W.1.

FTS (design). No. B691,388. Class 9. Electric condensers, electric contacts and speedometer cables.—F. Taylor & Sons (Manchester), Ltd., 136-140, Bolton Road, Pendleton, Salford 6.

DAFLEX. No. B699,600. Class 9. Electric cables and insulated electric wires.—J. Day & Co. (Derby Works), Ltd., Harrow Manor Way, Abbey Wood, London, S.E.2.

AVISITE. No. 700,024. Class 9. Electric cables or conductors and fittings therefor included in Class 9, all prepared for use as fencing for protecting buildings and other enclosures against marauding animals.—W. Elliot, 8, Drumlanrig Square, Hawick, Scotland.

SCOTCH BOY. No. 700,171. Class 9. Magnetized tape for use as sound-recording media; and luminous signs.—Minnesota Mining & Manufacturing Co., U.S.A. Address for service, c/o Stevens, Langner, Parry & Rollinson, 5-9, Quality Court, Chancery Lane, London, W.C.2.

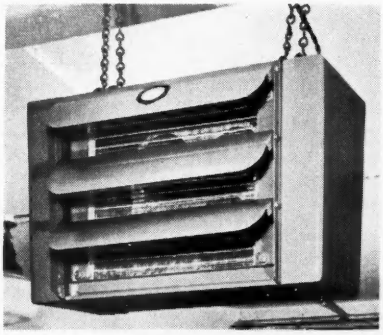
VIBRATONE. No. 700,200. Class 9. Electric sound amplifiers for use with musical instruments.—Jennings Musical Instruments, Ltd., 119, Dartford Road, Dartford.

RECENT INTRODUCTIONS

NOTES ON NEW ELECTRICAL AND ALLIED PRODUCTS

Unit Heater

A COMPACT pendant electric heater introduced by HURSEAL, LTD., 229, Regent Street, W.1, is particularly suitable for buildings where floor space cannot be provided for radiators, where neither steam nor hot water is available,



Hurseal unit heater

or where it is inconvenient to install a boiler. It consists of a fan encased in a heavy-gauge enamelled sheet metal casing, with a louvred front controlling the air stream. A safety cut-out prevents the temperature of the heating element rising beyond a predetermined value. If a short length of ductwork is connected with the outside air, the fan can be used separately for ventilation. The heater is available in three standard loadings: 2·625 kW (price £13 19s 6d), 5·25 kW (£18 19s 6d) and 10·5 kW (£29 19s 6d), all models being convertible for use on either single or three-phase. D.c. models can be supplied.

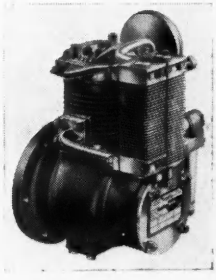
Lightweight Air Compressor

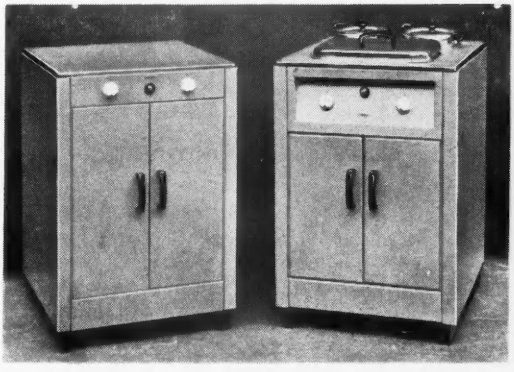
A 3,000 lb/sq in three-stage air compressor made by the HYMATIC ENGINEERING CO., LTD., Redditch, Worcs, has just been given its type approval by the Ministry of Supply. Designated the HC51, it provides a free air delivery of 1·5 cu ft/min at 1,500 r.p.m., under normally aspirated conditions, when delivering against a pressure of 3,000 lb/sq in. The weight is only 10 lb and the overall dimensions are 7in long by 6in wide by 8in high.

Hotcupboard and Bain Marie

The ARORA COMPANY, Rosebery Street Loughborough, announces the introduction of a 2ft "unit" hotcupboard and an alternative arrangement of its bain marie hotcupboard with entree dish and two soup pots instead of the standard arrangement of four soup pots. Both these units are self-contained but can be linked either together or to other of the Arora "unit" equipments. The small 2ft hotcupboard has been designed for positions where space is limited.

The control on both equipments is by means



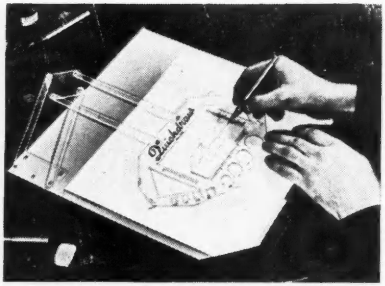


Hymatic lightweight air compressor. Right: Arora 2ft hotcupboard and bain marie hotcupboard

of "Simmerstats" when used on a.c. supply, and the elements fitted are of the Arora heavy duty armoured type which are drip proof and spill proof. The standard finish is stoved enamel polychromatic aluminium colour, but white or other colours can be supplied if required.

Sketching Device

An aid to the production of drawings and sketches known as the "Quickdraw" has just been placed on the market by the QUICKDRAW



"Quickdraw" sketching device

Co., 127, Gunnersbury Avenue, London, W.3. It consists of a "Perspex" templet designed to produce varying angles, triangles and rectangles, which are graduated in inches and millimetres. Circles are also incorporated with diameters ranging from $\frac{1}{16}$in to 1in. The templet is toggle hinged to a folder which acts as a drawing board over which it is adjusted to obtain the correct ruling guide. It is priced at 63s.

Dry Shaver Container

ARVIN ELECTRIC, LTD., Fernbrook Avenue, Southend-on-Sea, Essex, states that in future all Arvin "de-luxe" shavers will be supplied in the new "Wind-a-Pak" container in which the cutting head is protected by a rubber cushion. The mains lead is wound round the outside of the casing and concealed by a detachable plastic band that fastens with a stud. Non-slip rubber feet are fitted to the base and a crystal finish, transparent cover completes the assembly.

Four models are available for 6, 12, 100 to 125, and 200 to 250 V, suitable for either a.c. or d.c., and all are priced at £3 17s plus 19s 1d purchase tax.

The distributors for London, south and west of England, East Anglia and parts of the Midlands are HEDDON-SMITH & Co., LTD., Heddonia House, 374, Euston Road, London, N.W.1.

Hearing Aids

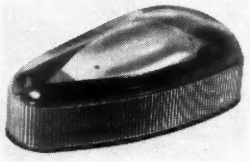
The new "G" series of hearing aids introduced by AMPLIVOX, LTD., 2, Bentinck Street, London, W.1, are smaller and lighter than their predecessors, have improved acoustic performance, permit closer prescription of individual requirements and cost less in upkeep. There are two types, model G for conductive deafness and model GA for perceptive cases. The former has a high acoustic gain and power output (maxima 67 db and 136 db respectively) while the latter incorporates a switch by means of which three degrees of automatic volume compression are provided.

Grill-Boiler

An improved 2 kW combined grill-boiler manufactured by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, has a 10$\frac{1}{2}$in by 8in boiling plate and is equipped with a 3-heat switch, grill pan, grid and deflector plate. The unit has a black vitreous enamel hob and cream finished body. The overall dimensions are: height 7$\frac{3}{4}$in, width 17$\frac{3}{8}$in, depth 10$\frac{1}{2}$in; grilling space, height 5in, width 12in, depth 9$\frac{1}{2}$in. The price of the new grill-boiler is £6 19s 8d.

Right: G.E.C. grill-boiler

Below: Arvin "Wind-a-Pak" container



FINANCIAL SECTION

Company Notes and Stock Exchange Activities

Reports and Dividends

Morphy-Richards, Ltd., report a trading profit for the year ended 30th June last of £245,649, as compared with £138,136 for 1949-50, to which is added investment income of £5,151, making £250,800. After making various provisions, including £131,090 for taxation, there is a group profit of £96,605 (against £42,102). It is proposed to pay a final dividend on the ordinary stock of 25 per cent, making 40 per cent for the year, and to carry forward £51,708 (against £9.533 brought in).

In his circulated statement Mr. G. Wansbrough (chairman) says that the total of the group sales shows an increase of 50 per cent above those of the previous year. The company produced 14 per cent more irons than in 1949-50, and the proportion exported was 40 per cent, against 25 per cent in the year before. The output of automatic toasters was just over double that of the previous year, and over 53 per cent were exported. Work is proceeding on the new factory which will add 60,000 sq ft to the available production space, and the directors hope that before this time next year the factory will be completed.

The East African Power & Lighting Co., Ltd.—Presiding at the annual meeting held in Nairobi on 22nd October, Mr. C. M. Taylor (chairman) said that their three companies provided 108.17 million kWh in 1950, as compared with 53.78 million in 1946, and 25.25 million in 1939, an increase of 328 per cent over the last pre-war and 113 per cent over the first post-war year. Good progress was being made with the capital construction programme and by the end of 1952 they should have in Nairobi, their major area, sufficient plant capacity to enable them to deal with additional business. Future schemes in hand would entail heavy capital expenditure and outstanding commitments for capital expenditure for the group at the end of December last amounted to £3,153,630. Consent of the Governments of Kenya and Tanganyika and of the Capital Issues Committee having been obtained, it had been decided to make an issue of 1,000,000 ordinary shares of 20s each.

A price of 32s 6d has been fixed for the new issue. Completion of the underwriting is announced by the Power Securities Corporation, and the prospectus was to be advertised to-day (Friday). The lists will open and close on 6th November, both in East Africa and the United Kingdom.

Bennis Combustion, Ltd.—The annual meeting was held on 26th October, Mr. T. Hough (chairman and managing director) presiding. In his circulated statement, Mr. Hough said that a considerable amount of time and labour had been spent in developing new machines to burn the varying grades of fuel available in the most efficient way, so as to give the greatest economies in their use for steam raising purposes. In addition to contracts with the British Electricity Authority and various Ministries for the defence programme, they had a large amount of work on hand for the gas industry, the National Coal Board and general industry. They had also opened up an appreciable amount of business in South Africa. They had decided to capitalize £37,500 from the reserves, such sum to be distributed to ordinary shareholders in the proportion of one new share for every two ordinary shares of 5s each held.

Peto Scott Electrical Instruments, Ltd., held its annual meeting on 26th October, Mr. M. Campbell Jones (chairman) presiding. In his circulated statement, the chairman said that the considerable improvement in profits had been brought about by heavy expansion of turnover due to an increased demand for their television products, together with the rapidly expanding Government contract side of the business. The recent radio exhibition in London had brought a satisfactory influx of orders, particularly from the North of England. The factory was working to full capacity on both civilian and Government work and they had long period contracts in respect of the latter.

Crompton Parkinson, Ltd., report a net income for the year ended 30th June last, after charging depreciation, taxation and provisions, of £489,245 (previous year £491,335). The consolidated net income of the group for the year was £550,128 after charging depreciation, taxation and provisions (previous year £560,710). In addition to the foregoing, provisions no longer required and profits relating to previous periods amounted to £63,249 (£109,500). The directors have decided to recommend a final dividend and cash bonus each of 3⅜ per cent actual (subject to tax) on the ordinary and "A" ordinary stocks in respect of the year (unchanged).

They have also decided to recommend the payment of £10,000 to the trustees of the central benevolent fund (previous year £5,000).

The British Electric Transformer Co., Ltd., reports a net profit for the year ended 30th June last, after charging depreciation, taxation and provisions, of £43,789, as compared with £68,861 for the previous year. It is proposed to pay a dividend of 2s 5d per share on the 5s ordinary shares, less tax (previous year 3s 10d). In addition to the foregoing, taxation amounting to £15,000 (previous year nil) has become recoverable in respect of the allowance for industrial buildings and the directors have decided to recommend its distribution by the payment of a special dividend on the ordinary shares of 6d per share, free of tax. The dividends on the ordinary shares are payable on capital increased during the year from £100,000 to £150,000 by the issue of a further 200,000 shares of 5s fully paid for in cash. In addition the directors have decided to declare an interim dividend of 1¼ per cent on the preference shares for the three months to 30th September, 1951, and to pay it at the same time as the 3¾ per cent for the nine months ended 30th June last.

Electric & Musical Industries, Ltd., report a consolidated net profit for the year to 30th June last, including dividends received from foreign subsidiaries, of £663,000, as compared with £342,809 for the preceding year. It is proposed to pay a final ordinary dividend of 4 per cent, making 12 per cent for the year (against a dividend of 6 per cent and a bonus of 2 per cent). Last month the directors announced an interim dividend of 8 per cent and their decision to recommend a final of 4 per cent, the amount to be either payable if circumstances permitted or carried to a special dividend reserve.

Crabtree Electrical Industries, Ltd., reports a consolidated trading profit for the year ended 31st July last of £461,310, as compared with £370,953 for the preceding year. After deducting £249,346 for taxation, £34,498 for depreciation, and meeting other charges, there is a group profit of £149,910 (against £135,956). It is proposed to pay a final ordinary dividend of 12½ per cent, maintaining the distribution for the year at 17½ per cent.

The Anglo-Portuguese Telephone Co., Ltd., has declared an interim dividend of 3 per cent (same).

New Companies

Horton, Goodchild & Co., Ltd.—Registered 16th October. Capital £1,000. Electrical engineers and contractors, electricians, ventilating and temperature control experts and advisers, etc. Directors: J. A. Horton, H. R. P. Boorman and W. A. Goodchild. Regd. office: 31, Tonbridge Road, Maidstone.

Carlton Refractories, Ltd.—Registered 23rd October. Capital £10,000. Manufacturers of and dealers in insulators and insulating materials, electrical porcelain products, etc. Subscribers: G. Brereton and A. J. Davenport. Solicitors: Breton, Bowcock & Deacon, Longton.

C. T. Henderson, Ltd.—Registered 22nd October. Capital £1,000. Dealers in radio, television, electrical and mechanical apparatus, etc. Directors: C. T. Henderson (chairman) and Mrs. Florence Henderson. Regd. office: "Beechfield," Towers Road, Poynton, Ches.

Lord's Controls, Ltd.—Registered 20th October. Capital £2,000. To acquire the business of Lord's Controls carried on by R. E. C. Lord and G. A. Side at 77a, High Street, Camberley, Surrey; and to carry on the business of electrical engineers and contractors, etc. Directors: R. E. C. Lord and G. A. Side. Regd. office: 77a, High Street, Camberley, Surrey.

Increases of Capital

Concordia Electric Wire & Cable Co., Ltd.—Increased by £100,000, in £1 shares, beyond the registered capital of £200,000.

Creed & Co., Ltd.—Increased by £150,000, in £1 ordinary shares, beyond the registered capital of £350,000. The International Standard Electric Corporation, of New York, U.S.A., holds practically all the issued shares.

Liquidation

Solar Electric Co., Ltd.—(Members' voluntary winding-up). Particulars of claims by 12th November to the liquidator, Mr. V. A. D. Kent of J. Hulbert Grove & Co., 9, Cavendish Square, London, W.1. This notice is purely formal. All creditors have been, or will be, paid in full.

Bankruptcies

F. Phillips, 28, Blenheim Terrace, St. John's Wood, London, N.W.8, electrical contractor, and lately trading as F. Phillips & Son, at the same address, as electrical contractors.—First meeting held 1st November. Public examination 7th December, at Bankruptcy Buildings, Carey Street, London, W.C.2.

H. J. A. Wade and **C. L. Wade,** carrying on business as C. & H. Wade & Co., at 40, Dulwich Road, Herne Hill, London, S.E.24, and lately carrying on business at 68, Brixton Water Lane, Brixton, S.W.2, electrical engineers and contractors.—Last day for receiving proofs for dividend 6th November. Trustee, Mr. W. F. Cresswell, Bankruptcy Buildings, Carey Street, London, W.C.2.

STOCKS and SHARES

STOCK Exchange markets have settled down quietly after the first effects of the General Election, causing as they did slight disappointment at the slenderness of the majority. The previous exuberance, brought about by anticipation of a more substantial swing to the right had led to the building up of a bull account in some of the more popular shares, and a measure of hesitation naturally followed upon publication of the final figures. Now it remains to be seen how investment will view the prospect, seeing that dividend limitation has gone by the board, to be replaced later by E.P.T. For the time being, the hesitation is likely to continue, with caution uppermost. There is no doubt that abundance of money is still available for investment.

Price Changes

A good many alterations in prices have occurred during the past week, the movements being of mixed order. Demand is selective and shares are singled out in those companies which show earnings well above the dividends distributed. Amongst a number of improvements that have occurred are Automatic Telephone, 74s 6d, Associated Electrical Industries 93s 6d, English Electric and Chloride, both 71s 3d, Hoover 33s 9d and Marconi Marine 37s 6d. Crompton Parkinson are 6d lower at 12s. The company announces a dividend making 11¼ per cent for the year. The British Electric Transformer Company, which is controlled by Crompton Parkinson, recommends a dividend making 48¼ per cent, as against 76⅔ per cent previously on a smaller capital. In addition, the directors propose a special dividend on the ordinary shares of 6d free of tax, this arising from taxation which has become recoverable. Telephone Properties reacted a little to 38s 3d after their previous sharp rise. East African Power 37s, are lower in consequence of the new issue. De La Rue, 36s 3d, and Lancashire Dynamo 53s 9d, are both 1/16 down on the week.

Conservative Dividends

Whichever way the election went, it was fairly certain that the shares of companies which had been consistently conservative in their dividend policies would show to relatively good advantage in subsequent market events. Practically all the popular investments in the electrical equipment market possess sound qualifications in that respect. A.E.I's last dividend of 20 per cent came from earnings equivalent to about 100 per cent on the ordinary capital; G.E.C. paid 22½ per cent from earnings of over 80 per cent; English Electric 15 from earnings of 45 per cent; Automatic Telephone 15 from 99 per cent. C. A. Parsons, A. Reyrolle and Joseph Lucas come near the top of any industrial share list concerned with dividend conservatism. Of the cable-makers, B.I.C.'s 7½ per cent dividend was covered more than five times by distributable profits. Both Siemens and London Electric Wire paid a total of 10 per cent in each case from surpluses equal respectively to 35 and 60 per cent. Henley's last dividend was covered 3½ times.

Good Cover

Other electrical shares noted on account of the particularly large margin between profits earned and distributed, include Ericsson Telephones and Chloride Electrical Storage ordinary, on both of which the last payment was covered about five times over. From the same point of view, mention may be made of the last dividends (with the corresponding earnings shown in parentheses) of 12½ (55) per cent by Laurence Scott & Electromotors; 12½ (49) per cent by Allen West; 20 (165) per cent by Telegraph Condenser; 20 (100) per cent by Dubilier Condenser; 20 (67) per cent by Rheostatic; 45 (298) per cent by Ward & Goldstone; 30 (119) per cent by British Thermostat; 25 (98) per cent by E. K. Cole; and the list could be extended to include others from a market which owes much of its reputation to the manner in which electrical engineering businesses have been developed out of retained profits.

Crabtree Electrical Results

The final dividend of 12½ per cent declared just before polling day by Crabtree Electrical Industries brought the total for the year to the same 17½ per cent that has been paid in every year since the company was formed, in 1936, to take over J. A. Crabtree & Co., and other electrical interests. Preliminary profit figures for the year ended last July show that progress has been maintained to the extent of a further £90,000 rise in the group trading profit, at £461,000. Much higher tax provisions leave a comparatively modest increase in the net figure, of £150,000 out of which the preference and ordinary dividends of the parent firm together require £65,000 net. No doubt the balance sheet and full accounts will confirm in due course the established position of the shares among the highly regarded investments in the London and the Birmingham markets.

E.I.B.A. Donation

AS a result of the collections taken at the meetings of the Electrical Fair Trading Council during the past financial year, the sum of £18 9s has been collected on behalf of the Electrical Industries Benevolent Association.

NEW BOOKS

Industrial Administration and Management. By F. L. Meyenberg, M.I.Mech.E. (387 pp.). Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, W.C.2. Price 35s.

The author's main purpose in writing this book was to provide a textbook covering the syllabus of Section C of the Institution of Mechanical Engineers' associate membership examination and the corresponding examinations of the I.E.E. and other institutions.

A great deal of useful matter is included and the scope is wide as the subjects of the five sections indicate:—Sales promotion; design; production planning and control; execution of works orders; and economic control.

The author, who is himself in a nationalized industry, says that so far as internal management (which is what the book deals with) is concerned no distinction is to be made between public and private businesses.—J.H.C.

Servomechanisms and Regulating System Design, Vol. I. By H. Chestnut and R. W. Mayer. Pp. 505; figs. and index. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 62s in U.K.

This is the first of two volumes intended to provide a comprehensive text-book on servomechanisms and regulators. The greater part of the first volume presents the principles of operation and methods of analysis that are well established. The preface states that the second volume will include such topics as non-linear operation, the selection of system elements, a.c. servos and measuring techniques. The groundwork for a useful book is well laid in Volume I, though if it were not for the promise of more to come the need for such matter, which largely parallels existing textbooks, might be questioned.

The authors are practising engineers with experience in teaching engineering students, and they have attempted to present the analysis, including the mathematics, in a way that the engineer will intuitively accept and learn to apply. Formal mathematics is minimized. The Laplace transformation, for example, is introduced early in the volume in a way that just suffices for practical use in the most usual type of problem. This is probably a good method if readers are thereby stimulated to broaden their grasp of the mathematics later by wider reading.

The treatment is mainly in terms of frequency response, with an extensive account of the use of the log gain characteristics plotted as a function of frequency. A new contribution to the data previously available is contained in Chapter 14, namely, a large collection of curve-sheets giving useful information about both the response to unit-function input and the response to sinusoidal inputs for a variety of simple transfer functions. It is claimed that the responses in the case of the more complex functions usually encountered in practice can often be estimated by judicious selection of the nearest approximation from those curves.

The book includes a selection of exercise problems and a bibliography, and is well produced. The further volume will be awaited with interest.—A.T.

Books Received

Large Size Perfect Diffusors. By H. Zijl. Pp. 196; figs. 120; index. Cleaver Hume Press, Ltd., 42a, South Audley Street, London, W.1. Price 30s in U.K.

Electro-Plating. By S. Field and A. D. Weill. Sixth edition. Pp. 546; figs. 96; index. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London, W.C.2. Price 20s.

Plastics and Building. By E. F. Mactaggart and H. H. Chambers. Pp. 181; figs. and index. Sir Isaac Pitman & Sons, Ltd. Price 60s.

Theory and Design of Valve Oscillators. By H. A. Thomas. Second edition. Pp. 317; figs. 157; index. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 36s.

Small Non-Commutator Motors. By W. L. McDougal and K. C. Graham. Pp. 256; figs. and index. Technical Press, Ltd., Gloucester Road, Kingston Hill, Surrey. Price 35s in U.K.

Autobiography of Robert A. Millikan. Foreword by Sir George Paget Thomson, F.R.S. Pp. 334 + xvii; appendices and index. Macdonald & Co. (Publishers), Ltd., 16, Maddox Street, London, W.1. Price 21s.

NEXT WEEK'S EVENTS

Monday, 5th November

BIRMINGHAM.—James Watt Memorial Institute' Great Charles Street, 6 p.m. I.E.E. South Midland Centre. "Economic Plant Sizes and Boiler-Set Groupings on the British Grid," by B. Donkin and P. H. Margen.

ILFORD.—Angel Hotel, 8 p.m. A.S.E.E. North-East London Branch. "General Motor Control Gear," by S. H. Harding.

LEEDS.—Great Northern Hotel, Wellington Street, 7.30 p.m. A.S.E.E. Leeds Branch. "Electro-mechanical Aids to Radiological Technique," by E. D. Ormerod.

LIVERPOOL.—Royal Institution, Colquitt Street, 6.30 p.m. I.E.E. Mersey & North Wales Centre. "The Life and Work of Oliver Heaviside," by Prof. G. H. Rawcliffe.

LONDON.—Savoy Place, W.C.2, 7 p.m. I.E.E. London Students' Section. "Power Station Practice, with particular reference to Earley Power Station," by J. E. G. Silvester and M. G. Nash.

MANCHESTER.—At the Geographical Society, 16, St. Mary's Parsonage, 7.30 p.m. Junior Institution of Engineers, North-Western Section. "Modern Electric Traction," by J. K. Brown.

NEWCASTLE-ON-TYNE.—King's College, 6.15 p.m. I.E.E. North-Eastern Radio & Measurements Group. "Crystal Triodes," by T. R. Scott.

SHEFFIELD.—Royal Victoria Station Hotel, 7.30 p.m. A.S.E.E. Sheffield Branch. "Electric Discharge Lamps," by A. E. Bird.

STONE.—P.O. Central Training School, 7 p.m. I.E.E. North Staffordshire Sub-Centre. "Television," by C. T. Lamping.

Tuesday, 6th November

CAMBRIDGE.—Cambridgeshire Technical College, 6 p.m. I.E.E. Cambridge Radio Group. Address by Dr. D. C. Espley, Chairman of the Radio Section.

CARDIFF.—Demonstration Theatre, S. Wales Electricity Board, 5.45 p.m. I.E.S. Cardiff Centre. "Lighting of Departmental Stores," by L. E. Gibbs.

GLASGOW.—At the Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, 7 p.m. I.E.E. Scottish Centre. "The Planning of an Electricity Board's Distribution System," by G. O. McLean.

HAMMERSMITH.—Windsor Castle Hotel, 134, King Street, 7.30 p.m. A.S.E.E. West London Branch. "Review of Soviet Industry To-day."

LONDON.—Savoy Place, W.C.2. 5.30 p.m. I.E.E. Measurements Section. Discussion on "Measurements Involved in the Testing of Protective Equipment," opened by H. S. Petch.

LOUGHBOROUGH.—The College, 6.30 p.m. I.E.E. East Midland Centre. "The Development and Application of the Vibrator as a Competitor of the Rotary Convertor," by Dr. J. H. Mitchell.

MANCHESTER.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Centre. "A Review of Research in Electricity Supply," by C. W. Marshall.

RUGBY.—College of Technology and Arts, 6.30 p.m. I.E.E. Rugby Sub-Centre. "The Continental Development of Single-Anode Mercury-Arc-Rectifier Valves of High Power," by Dr. -Ing. H. von Bertele.

Wednesday, 7th November

ABERDEEN.—Caledonian Hotel, Union Terrace, 7.30 p.m. I.E.E. North-East Scotland Sub-Centre, "The Evolution of the Lighting Art," by Dr. J. W. T. Walsh.

EDINBURGH.—Heriot-Watt College, 7 p.m. I.E.E. Scottish Centre. "The Planning of an Electricity Board's Distribution System," by G. O. McLean.

Welfare Club Hall, City Lighting & Cleansing Department, 357, High Street, 7 p.m. I.E.S. Edinburgh Centre. "Sports Lighting—Indoor and Outdoor" by D. E. Beard.

MANCHESTER.—College of Technology, 7.15 p.m. A.S.E.E. Manchester Branch. "Developments in Fluorescent Lighting," by Dr. J. W. Strange.

MIDDLESBROUGH.—Cleveland Scientific and Technical Institute, 6.30 p.m. I.E.E. Tees-Side Sub-Centre. "The Characteristics and Control of Rectifier-Motor Variable-Speed Drives," by P. Bingley.

NEWCASTLE-ON-TYNE.—Minor Durrant Hall, Oxford Street, 6.15 p.m. I.E.S. Newcastle Centre. "Glass in the Service of Light," by A. J. Holland.

SCUNTHORPE.—Technical School, 7 p.m. I.E.E. Sheffield Sub-Centre. "L.T. Industrial Control Gear and its Applications," by S. H. Harding.

SOUTHAMPTON.—Polygon Hotel, 6.30 p.m. I.E.E. Southern Centre. "Electrical Control of Dangerous Machinery and Processes: Part II—Electrically Interlocked Guards on Machines," by W. Fordham Cooper.

STAFFORD.—Association Hall, English Electric Co., Ltd., 7.15 p.m. I.E.E. South Midland Students' Section. Chairman's Address, by G. Campbell.

WOOD GREEN.—Three Jolly Butchers Hotel, 8.15 p.m. A.S.E.E. North London Branch. "Modern Lift Practice," by W. A. Dixie.

YORK.—Feasgate Restaurant, Feasgate, 7.30 p.m. A.S.E.E. York Branch. "Flameproof Fittings," by J. H. Mollan.

Thursday, 8th November

BRISTOL.—Grand Hotel, 7.30 p.m. A.S.E.E. Bristol Branch. "Fluorescent Lighting and the Maintenance Engineer," by A. G. Mitchell.

DUNDEE.—Royal Hotel, Union Street, 7 p.m. I.E.E. North-East Scotland Sub-Centre. "The Evolution of the Lighting Art," by Dr. J. W. T. Walsh.

GLASGOW.—At the Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, 6.30 p.m. I.E.S. Glasgow Centre. "Indoor and Outdoor Sports Lighting," by D. E. Beard.

KETTERING.—George Hotel, 7 p.m. I.E.E. East Midland Centre. District meeting. "The Deterioration of Mains Cables due to External Causes," by P. W. Cave.

(*Continued on next page*)

LEEDS.—B.E.A Offices, Whitehall Road, 6.45 p.m. E.P.E.A. West Yorkshire Technical Group. "Economy in the Choice of Switchgear," by L. J. Bamber.

LIVERPOOL.—Electricity Showrooms, Whitechapel, 7 p.m. E.P.E.A. Merseyside Technical Group. "Power Station Lubrication," by G. H. Clark.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. Institution of Electrical Engineers. "The London-Birmingham Television-Cable System," by T. Kilvington, F. J. M. Laver and H. Stanesby. (Radio Section paper.)

Management House, Hill Street, W.1, 7 p.m. Institute of Industrial Administration, London Centre. "Problems of Office Management," by O. W. Standingford.

MANCHESTER.—Town Hall Extension, 6 p.m. I.E.S. Manchester Centre. "Hospital Lighting," by D. J. Reed and M. W. Peirce.

SWANSEA.—Central Library, Alexandra Road, 6 p.m. I.E.E. West Wales (Swansea) Sub-Centre. "The Protection of Electrical Power Systems—A Critical Review of Present-Day Practice and Recent Progress," by H. Leyburn and C. H. W. Lackey.

Friday, 9th November

CREWE.—Crewe Arms Hotel, 7.30 p.m. A.S.E.E. Crewe Branch. "Electric Welding," by W. Barnett.

HAMPTON COURT.—Casino, Taggs Island. E.C.A. Surrey Branch. Annual dinner.

LONDON.—Grosvenor House, Park Lane, W.1, 7 p.m. Electrical Industries Ball.

Caxton Hall, S.W.1, 6.30 p.m. E.P.E.A. Southern Meter Engineers' Group. "The Use of the Cathode-ray Oscillograph to Meter and Test Engineers," by O. H. Davie.

39, Victoria Street, S.W.1, 6.30 p.m. Junior Institution of Engineers. Informal meeting. "The Engineer and Safety," by F. M. Panzetta.

NEWCASTLE-ON-TYNE.—King's College, 6.30 p.m. I.E.E. North-Eastern Students' Section. "Electronic Motor Control," by C. R. Bates.

NOTTINGHAM.—Electricity Showroom, Smithy Row, 7.30 p.m. A.S.E.E. Nottingham Branch. "Estimating," by W. Brooks.

Saturday, 10th November

LONDON.—Earls Court. International Cycle and Motor Cycle Exhibition. (Until 17th November.)

Canadian Electrical Exports

ELECTRICAL exports from Canada during the first half of this year increased appreciably on the corresponding period of 1950, thus recovering some of the ground lost between 1949 and 1950. The accompanying table gives the values of some of the principal items with notes of increases or decreases during the period covered. It will be seen that advances took place in all but the motor trade, those in generators and dynamos being tenfold and in transformers fourfold. Distribution was over a wide range of markets.

Class of Goods	Six months to June, 1951 $ (000)	Inc. or dec. on six months to June, 1950 $ (000)	Class of Goods	Six months to June, 1951 $ (000)	Inc. or dec. on six months to June, 1950 $ (000)
Batteries, storage	395	+ 212	Dynamos, generators and parts	468	+ 413
To Indonesia	14	+ 14	*To United States*	103	+ 100
„ *South Africa*	27	+ 20	„ *S. Africa*	16	+ 14
„ *Belgian Congo*	28	+ 20	„ *Cuba*	23	+ 5
„ *British Guiana*	13	+ 12	„ *Australia*	74	+ 74
„ *Ceylon*	12	— 6	„ *Brazil*	201	+ 199
„ *Venezuela*	122	+ 69	„ *French Africa*	27	+ 21
„ *Chile*	46	+ 45	Motors and parts	469	— 171
Batteries, other	399	+ 311	*To Australia*	151	+ 36
To Malaya	321	+ 276	„ *New Zealand*	16	— 23
„ *Fr. E. Indies*	12	+ 12	„ *Venezuela*	9	— 19
„ *Philippines*	36	+ 36	„ *Brazil*	70	+ 24
Radio receiving sets	596	+ 116	Transformers and parts	1,230	+ 918
To Panama	24	+ 5	*To Bolivia*	31	+ 31
„ *Venezuela*	187	+ 61	„ *Brazil*	1,188	+ 1,126
„ *Peru*	51	+ 51	Meters and parts	1,187	+ 51
„ *Guatemala*	24	+ 10	*To Brazil*	282	+ 107
„ *Siam*	23	+ 18	„ *Chile*	103	— 9
Radio apparatus, other	1,033	+ 246	„ *Cuba*	231	+ 141
To United States	765	+ 373	„ *Mexico*	264	122
„ *Mexico*	76	+ 72	„ *Venezuela*	116	+ 46
„ *Brazil*	140	+ 72	Spark plugs, magnetos, etc.	787	+ 370
Telegraph and telephone apparatus	308	+ 205	*To South Africa*	205	+ 95
To Brazil	47	+ 39	„ *India*	102	+ 29
„ *United States*	218	+ 171	„ *Mexico*	126	+ 46
			Electrical apparatus, n.o.p.	1,248	+ 775

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s each) will be obtainable after 12th December from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1946

29672. Bendix Aviation Corporation.—Electrical automatic steering systems. 4th October, 1946. (662840.)

35452. Bendix Aviation Corporation.—Control system for alternating current motors. 29th November, 1946. (662841.)

1947

14998. Standard Telephones & Cables, Ltd.—Grids for electron-discharge devices. 6th June, 1947. (662632.)

21990. Radio Corporation of America.—Cathode-ray tube apparatus. 8th August, 1947. (663034.)

28279. Bendix Aviation Corporation.—Frequency meter. 22nd October, 1947. (662849.)

32037. Morrison, A. C.—Generating plant for electricity. 19th November, 1948. (662636.)

32561. Standard Telephones & Cables, Ltd.—Determination of the class and/or condition of subscribers' lines. 10th December, 1947. (663037.)

1948

1027. Murphy Radio, Ltd., and Fairhurst, H. A.—Scanning control in television receivers. 2nd February, 1949. (663041.)

5093. Western Electric Co., Inc.—Telegraph interconnection system. 20th February, 1948. (662639.)

5447. Lignes Telegraphiques et Telephoniques.—Electronic generators of high-frequency alternating currents. 24th February, 1948. (662640.)

5985. Director of the Office of Technical Services, Department of Commerce.—Magnetrons. 27th February, 1948. (662642.)

19995. General Motors Corporation.—Carbon pile electrical regulators. 27th July, 1948. (662735.)

29081. Stevens, A. H. (Electric Storage Battery Co.).—Storage batteries and the manufacture thereof. 9th November, 1948. (662747.)

30044. Soc. des Usines Chimiques Rhonepoulenc.—Composition for, and method of, protecting electrical equipment. 18th November, 1948. (662749.)

31235. Philips Electrical, Ltd.—Circuits for automatic frequency correction. 2nd December, 1948. (662754.)

31787. General Electric Co., Ltd., and Gallizia, E.—Vapour-electric arc converters. 29th November, 1949. (662755.)

32476. Radio Corporation of America.—Electron-discharge device. 15th December, 1948. (662757.)

33173. Pye, Ltd., and Blackler, E. R.—Volume control devices. 24th March, 1950. (662759.)

1949

165. English Electric Co., Ltd., and Houston, T. R.—Distribution valves. 16th December, 1949. (662652.)

211. General Electric Co., Ltd., and Friedlander, E. S.—Protective devices for alternators or synchronous alternating current motors. 4th January, 1950. (662761.)

503. Electric Furnace Co., Ltd., and Howard, J. C.—Electric induction heating apparatus. 5th January, 1950. (662935.)

895. Wipac Development, Ltd., and Gayler, G. A.—Rotary dynamo-electric machines. 5th January, 1950. (662765.)

2158. Burndept, Ltd., Jones, K., and Bell, G. S.—Manufacture of electric dry cells. 24th January, 1950. (662774.)

2885. Metropolitan-Vickers Electrical Co., Ltd.—Electrical switchgear. 1st February, 1950. (662778.)

3133. Standard Telephones & Cables, Ltd. (Nederlandsche Standard Electric Maatschappij N. V.).—Signalling systems employing d.c. impulses over an a.c. supply line. 4th February, 1949. (662655.)

4678. Philips Electrical, Ltd.—Rotary anode X-ray tubes. 21st February, 1949. (662951.)

4886. Ferranti, Ltd., and Cluderay, E. S.—Self-starting synchronous motors. 23rd February, 1950. (662952.)

5150. Standard Telephones & Cables, Ltd.—Electric multi-switch. 25th February, 1949. (662784.)

5281. Yarwood, H. I., and Yarwood, A. T.—Electrically-tripped switches. 27th February, 1950. (Cognate application 13465, 20th May, 1949.) (662953.)

5714. Philips Electrical, Ltd.—Pulse-modulation signalling systems. 2nd March, 1949. (662956.)

6316. General Electric Co., Ltd., and Meacock, J. H.—Hydraulic apparatus. 8th March, 1950. (662961.)

6586. British Thomson-Houston Co., Ltd.—Electric switches. 10th March, 1949. (662964.)

7328. Westinghouse Electric International Co.—Electro-plating. 17th March, 1949. (Cognate application 7328, 18th February, 1948.) (662660.)

7925. British Thomson-Houston Co., Ltd.—Electric ranges, and cooking utensils. 23rd March, 1949. (662866.)

8087. Belling & Co., Ltd., and Belling, C. R.—Apparatus for warming plates, dishes and other like utensils. 7th February, 1950. (662966.)

8225. Laffon y Soto, A., and Selgas y Marin, E. de.—Means for diminishing background noise in the photo-electric recording of sound. 25th March, 1949. (Cognate application 8226, 7th December, 1948.) (662967.)

8496. Radio Corporation of America.—Delay devices. 29th March, 1949. (663054.)

8787. General Electric Co., Ltd., and Rudge, T. R.—Electrical indicating instruments. 31st March, 1950. (662792.)

8945. General Electric Co., Ltd., Electroflo Meters Co., Ltd., Davies, E. C., and Gemmell, D. C. N.—Automatic electric control systems for steam boiler auxiliaries. 31st March, 1950. (662971.)

9255. Radio Corporation of America.—Image recording apparatus. 5th April, 1949. (662870.)

10039. British Thomson-Houston Co., Ltd.—Electric protective system having grounded phase selectors. 13th April, 1949. (663055.)

10479. Crompton Parkinson, Ltd.—Circuit arrangements for discharge lamps. 19th April, 1950. (662977.)

10579. A.E.W., Ltd., and Watkins, A. E.—Earthing of electrical apparatus. 21st April, 1949. (662878.)

10743. Naamlooze Vennootschap Philips' Gloeilampenfabrieken.—Combinations of electric relays and circuits embodying such combinations. 22nd April, 1949. (662665.)

10768/9. Hazeltine Corporation. — Super-regenerative superheterodyne wave-signal receiver. 22nd April, 1949. (662666/7.)

10995. General Electric Co., Ltd., and Worden, W. R.—Electrical systems of remote control. 1st March, 1950. (662668.)

12125. Morris Motors, Ltd.—Electronic time base generators. 3rd May, 1950. (662675.)

12579. Radio Corporation of America.—Phase invertor system.—11th May, 1949. (662677.)

12646. Raleigh Cycle Co., Ltd., and Holliday, L. A.—Electric lighting circuits for pedal bicycles. 27th April, 1950. (662678.)

13967. Stevens, A. H. (Electric Sorting Machine Co.).—Photoelectric sorters. 25th May, 1949. (662685.)

14168. Ozalid Co., Ltd., and Easter, J. W.—End connection for tubular electric lamps. 16th May, 1950. (662994.)

14246. Radio Corporation of America.—Tunable band-pass coupling circuit for electronic amplifiers. 27th May, 1949. (662995.)

14272. Sangamo Weston, Ltd., and McBride, M. G.—Electrical measuring instruments. 1st February, 1950. (662686.)

14280. Siemens Bros. & Co., Ltd.—Telephone jack assemblies. 26th May, 1950. (662687.)

14695. Philco Corporation.—Projection screen. 1st June, 1949. (Addition to 638141.) (662689.)

14728. British Thomson-Houston Co., Ltd.—Electromagnetic induction devices. 1st June, 1949. (662690.)

14981. Forges & Ateliers de Constructions Electriques de Jeumont.—Remote-control operating systems for electric circuit breakers. 3rd June, 1949. (Cognate application 14982, 19th October, 1948.) (663001.)

15006. Aladdin Industries, Inc.—Variable inductances. 3rd June, 1949. (662691.)

15007. Aladdin Industries, Inc.—Tuning inductor. 3rd June, 1949. (662692.)

15408. Hazeltine Corporation.—Angular velocity modulation wave-signal translating system. 9th June, 1949. (Addition to 638111.) (662693.)

16231. Metropolitan-Vickers Electrical Co., Ltd.—Vertical shaft alternators. 15th June, 1950. (662809.)

17536. General Motors Corporation.—Control device for electric motors. 2nd July, 1949. (662703.)

17756. Midgley, A. M.—Clockwork electric time switches. 5th July, 1950. (663008.)

17855. Standard Telephones & Cables, Ltd., and Boff, A. F.—Impedance measuring equipment. 6th July, 1949. (662707.)

18688. Standard Telephones & Cables, Ltd., and Storr-Best, J. L.—Monitoring arrangements for telegraph systems. 15th July, 1949. (662709.)

18706. Igranic Electric Co., Ltd.—Web-severing devices. 15th July, 1949. (662817.)

18718. Office National d'Etudes et de Recherches Aeronautiques O.N.E.R.A.—Spectrophotometers intended to measure the transparency or opacity of a substance, in particular, to infra-red light. 15th July, 1949. (662818.)

19242. British Thomson-Houston Co., Ltd.—Weight shifting compensating arrangements for electric vehicle trucks. 21st July, 1949. (662710.)

19253. General Electric Co., Ltd., and Harrold, A. E.—Bobbins for transformers and chokes having laminated cores. 30th June, 1950. (662711.)

19558. Libois, L. J., and Gloess, P. F. M.—Method and corresponding devices for the transmission of signals by coded pulses. 25th July, 1949. (662823.)

20460. Maschinenfabrik Oerlikon.—Switch arrangement for systems including single-anode mercury vapour rectifiers. 5th August, 1949. (662902.)

20552. Allmanna Svenska Elektriska Aktiebolaget.—Air blast electric circuit breaker for large currents. 8th August, 1949. (662826.)

22199. Plessey Co., Ltd.—High-frequency induction coils. 8th June, 1950. (662909.)

22292. Damond, E.—Automatic weighing machines using electronic oscillatory means. 26th August, 1949. (Addition to 639461.) (662718.)

23608. British Thomson-Houston Co., Ltd.—Laminated core constructions of electric induction apparatus. 13th September, 1949. (662911.)

23804. Compagnie Générale de Télégraphie sans Fil.—Ceramic dielectric. 15th September, 1949. (662828.)

25453. Westinghouse Electric International Co.—Three-phase core structures for electrical induction apparatus. 4th October, 1949. (662915.)

27725. Landis & Gyr. Soc. Anon.—Resonant relay. 28th October, 1949. (662917.)

27731. Noyes, R. C. (Compagnie Générale d'Electricité.) Joining of electric cables. 28th October, 1949. (662728.)

28191. Anderson, Boyes & Co., Ltd., and Anderson, A.—Flameproof electric switchgear boxes. 25th December, 1949. (Addition to 623161.) (663017.)

30027. Western Electric Co., Inc.—Multiplex carrier-frequency electrical signal transmission systems. 23rd November, 1949. (662922.)

31040. Akt.-Ges. Brown, Boveri & Cie.—Arrangement for determining the contact time of the periodically-actuated contacts of switching devices. 2nd December, 1949. (Addition to 654624.) (663022.)

31775. Airborne Instruments Laboratory, Inc.—Impedance measuring apparatus. 10th December, 1949. (662923.)

32926. Standard Telephones & Cables, Ltd., and MacMullan, J. S. M.—Electric synchronized switching arrangements. 23rd December, 1949. (663028.)

33366. Western Electric Co., Inc.—Signalling systems. 30th December, 1949. (662930.)

1950

21316. British Vacuum Cleaner & Engineering Co., Ltd., and Briggs, G.—Phase-shifting network. 28th October, 1948. (Divided out of 643036.) (663030.)

Amended Specification

646739. Marconi's Wireless Telegraph Co., Ltd.—Electrical coupling circuit arrangements.

AUSTRALIAN ELECTRICAL TRADE

DURING the nine months ended March last Australian imports of dynamo-electric machinery and electrical appliances and equipment increased in value by over 25 per cent compared with the corresponding period of 1949–50. From the following table it will be seen that the advance occurred mainly in communication equipment, including radio.

Class of goods	Nine months ended March	
	1950 £A(000)	1951 £A(000)
Batteries and accumulators ..	347	417
Cable and wire, covered ..	4,486	3,504
Communication equipment, including radio	4,450	6,256
Dynamo-electric machines	3,569	3,732
Lamps, filament	465	639
Protective equipment	443	486
Regulating, starting and controlling apparatus	1,444	2,711
Transformers and rectifiers ..	565	1,341
Other elec. machinery and appliances	1,657	2,345

Exports of dynamo-electric machinery and electrical appliances and equipment totalled £A1,115,000 in value compared with £A987,000. They included communication equipment valued at £A242,000, against £A334,000 in the corresponding period of 1949–50.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section, the date of the issue is given in parentheses.

Ashington (Northumberland).—U.D.C. Electrical work in connection with erection of 25 houses in Blyth Terrace. Council's surveyor.

Australia. — SYDNEY. — 28th November. Department of Railways, N.S.W. Indoor metal-clad switchgear. (C.R.E. (I.B.) 73295/51. Ten/3142.)*

29th November. County Council. Remote water level indicators and alarms for sundry tanks at Pyrmont "B" power station. (C.R.E. (I.B.) 73407/51. Ten/3144.)*

Ellesmere.—15th November. U.D.C. Public lighting installation. (See this issue.)

Gateshead.—26th November. Corporation. Electrical installation at Southend Road School. (See this issue.)

India.—NEW DELHI.—27th November. Director General Supplies and Disposals. Supply of 18 miles of copper contact wire. (See this issue.)

Ireland.—DUBLIN.—1st February. Electricity Supply Board. Hydro-electric generating plant at Inniscarra and Carrigadrohid stations. (See this issue.)

London.—LEWISHAM.—24th November. Street lighting columns. (See this issue.)

Manchester.—15th November. City Council. Electrical installation at Hall Lane Police Station, Wythenshawe. City architect.

New Zealand.—AUCKLAND.—12th November. Electric Power Board. Supply of 6.6 kV cable. (C.R.E. (I.B.) 73454/51. Ten/3135.)*

South Africa.—BLOEMFONTEIN.—19th November. City Council. 11 kV outdoor polemounting circuit breakers and outdoor fuse cut-outs. (C.R.E. (I.B.) 73876/51. Ten/3132.)*

PORT ELIZABETH.—6th December. City and water engineer. Three sets of electrically-driven pumping equipment for proposed Sea View pumping station. (C.R.E. (I.B.) 73760/51. Ten/3143.)*

Southport.—19th November. Supply of cable for pier illuminations. (See this issue.)

Sunderland.—15th November. Corporation. Electrical installation in Thorney Close Junior and Infants' Schools. (See this issue.)

West Hartlepool.—Corporation. Electrical installation at Dinsdale Lodge old persons' hostel. Borough architect, Municipal Buildings

*Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Thames House North, Millbank, S.W.1 (Victoria 9040).

ORDERS PLACED

Birkenhead.—Corporation Education Committee. Rewiring section of electrical installation at Laird School of Art (£254).—C. F. Wills & Co.

Caterham & Warlingham.—U.D.C. Housing Committee. Recommended. Installation of electricity in 12 houses at Church Road, Warlingham (£588).—Tree Electrical Co.

Coventry.—Corporation Education Committee. Electrical installation at Limbrick Wood Primary School.—Hartley Electromotives, Ltd.

Edmonton.—Borough Council. Electrical installations in houses on the Flamstead End estate (£3,071).—Holmes & Larkinson.

London.—ISLINGTON.—Borough Council Works Committee. Recommended. Side street lighting improvements (£3,926).—Metropolitan-Vickers Electrical Co., Ltd.

CONTRACTS IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—Electrification of Premnay, Logie-Durno and Cluny schools and schoolhouses; Tawse & Allan, architects, 343, Union Street, Aberdeen.

Bathavon.—Dwellings (42), Bathford; H. H. Goldsmith, architect to R.D.C., 18, Gay Street, Bath.

Bracknell.—Factory; Hydraulic Coupling & Engineering Co., Ltd., Fluidrive Works, Worton Road, Isleworth.

Burton-on-Trent.—Phase 1 of technical college (£174,875); George Hodges & Son, Ltd., Horninglow Street.

Houses (79), Manners estate; borough surveyor.

Carlisle.—Additions to Garlands Mental Hospital; Graham & Roy, architects, Paternoster Row, Carlisle.

Central kitchen in Adelaide Street; city engineer, 18, Fisher Street, Carlisle.

Chanctonbury.—Houses (98), on sites at Henfield, Pulborough and Steyning; R.D.C. surveyor, Council Offices, Storrington, Sussex.

Chelmsford.—Additions to staff quarters at St. John's Hospital, Wood Street, for North Essex Metropolitan Hospital Board; Moore, Simpson & Claverley, architects, 34, Bedford Row, London, W.C.1.

Coventry.—Dwellings for T.C.; Flatlets (52) and houses (8) at Stonebridge Highway estate; J. K. Monsell (Contractors), Ltd., Blondvil Street.

Flats (12), Bradford Road and Brownshill Green Road; T. Bates & Son, Ltd., 53, Warwick Street.
Works, Cromwell Lane; Valves, Ltd., Parkside.

Croydon.—Mental observation ward and psychiatric clinic at Mayday Hospital, Thornton Heath, for Regional Hospital Board; T. G. Crump, architect, 43, George Street, Croydon.

Dagenham.—Factory, Hainault industrial estate; Tiffen & Bealer, Ltd., 3, Pine Street, London, E.C.1.

Darlington.—Children's home; borough architect, Central Buildings.

Derby.—Additions at Etwall Rehabilitation Centre (£63,152) for Regional Hospital Board; Ford & Weston, Ltd., builders, Derby.

Durham.—School, New Penshaw (£52,000); Holland and Hannen & Cubitts, Ltd., builders, Howdon, Wallsend.

East Ham.—Eight-storey block of 96 flats, Priory Road; Thomas Bates & Son, Ltd., builders, Harold Wood, Romford.

Eccles.—Shops at Ellesmere Park estate; borough surveyor.

Gosport.—Fire station, Privett Road, for Hampshire C.C.; borough engineer, Town Hall.

Harrow.—Houses (37), Castleton Road, eight houses and two shops, Whittington Way, Pinner, and six old people's dwellings, College Hill Road, Harrow Weald; H. Wells, clerk to U.D.C., Harrow Weald Lodge.

Hayes.—Grammar school, Wood End Green Road, for Middlesex E.C.; chief education officer, 10, Great George Street, S.W.1.

Hebburn-on-Tyne.—Houses (76) on the Hartleyburn estate extension for U.D.C.; W. Leech, Ltd., builders, Clayton Street, Newcastle-on-Tyne.

Hull.—First section of technical college, Queen's Gardens (£270,000); city architect, Lowgate.

Ilkeston.—Houses (93) for Stanton Housing Co., Ltd.; Rice & Beck, Ltd., High Road, Totton, Beeston and F. Perks & Son, Ltd., builders, Bridge Street, Long Eaton.

Leamington Spa.—Works at trading estate; Ludwell & Co., Ltd., Gordon Street, Coventry.

Leeds.—Children's home on site at Raynell Drive, Ireland Wood; city architect, Priestley House, Quarry Hill.

Leyland.—Large extensions for Leyland Motor Co., Ltd.; A. Monk & Co., Ltd., Padgate, Warrington.

London.—HAMMERSMITH.—Boiler house (£45,000) at St. Dunstan's Road Hospital; Johnson & Crabtree, architects, 8, Robert Adam Street, London, W1.
SOUTHWARK.—Factory, etc., Lavington Street; Nurdin & Peacock, Ltd., 59, Wells Street, W.1.
WESTMINSTER.—Ten-storey block of 60 flats, Churchill Gardens, for City Council; Powell & Moya, architects, 36, Great Smith Street, S.W.1.

Louth.—Out-patients' department at County Infirmary; H. Hall, architect, St. Mary's Gate, Grimsby.

Mitcham.—X-ray department and chest clinic, Cumberland Hospital; South West Metropolitan Regional Hospital Board, 11, Portland Place, W.1.

Middlesbrough.—Children's homes at Berwick Hills and at Park End (£10,000); borough engineer.

Newcastle-on-Tyne.—Psychiatric unit at Newcastle General Hospital for Regional Hospital Board, Osborne Road, Newcastle; P. H. Knighton, Board's chief architect.
Houses, flats and old people's houses (284), Slatyford Lane, for City Council; Newcastle Master Builders' Association.

Newcastle (Staffs).—Conversions at Roxy Cinema, Nelson Place, to provide civic theatre; borough surveyor, Lancaster Building, High Street.

North Riding.—Ambulance station at Malton; county architect, County Hall, Northallerton.

Portslade-by-Sea.—Dwellings (54), Mile Oak site, for U.D.C.; G. W. Warr & King, architects, Albion Street, Southwick, Sussex.

Portsmouth.—Scheme for development of estate at Leigh Park, with provision for houses, shopping centre, industrial buildings, etc.; city engineer, 1, Clarence Parade, Southsea.

Reading.—Houses (186), Bath Road; James T. Cook & Son, Ltd., builders, 11, Holmes Road.

Rugby.—Houses (30), Lawford Lane; Browning Construction Co., 69, Hillmorton Road, Rugby. Two blocks of 3-storey flats and 10 bungalows at Deepmore Road; Bosworth & Wakeford, Ltd., New Street, Daventry.

Sale.—Ambulance depot (£10,344); Sparke & Stevens, Ltd., 105, Wood Lane, Timperley.

Sheffield.—Large works extensions (about £85,000); Newton Chambers & Co., Ltd., Izal Works, Thorncliffe, Ecclesfield.
Factory, Sidney Street and Morpeth Street; F. W. Portass, 83a, Sellars Street.

Southampton.—Health clinic, Sullivan Road, Surrey House estate; R. R. H. Meggeson, town clerk, Civic Centre.

Southport.—Rebuilding Sunshine Home for Blind Babies at Birkdale; R. Rimmer, Ltd., Upper Aughton Road, Birkdale, Southport.

Stanley (Co. Durham).—Houses (45) on Shields Row site for U.D.C.; J. R. Heslop, surveyor.

Stockton-on-Tees.—Infants' school, Roseworth estate; borough architect, 28, The Square.

Sunderland.—Administrative offices at Seaburn for Corporation Entertainments Dept. (£12,000); borough architect, Grange House, Stockton Road.

Tewkesbury.—Factory; T. Swan & Co., Ltd., Love Lane, Rugeley, Staffs.

Wallasey.—Flats and bungalows at Blundell Drive, houses at Kestrel Road, bungalows and houses at Edgehill Road and flats and maisonnettes at Tom Meadow Lane; borough surveyor.

Watford.—Dwellings (225), Kytes estate, Garston; borough engineer.

West Hartlepool.—Conversion of Tunstall Court, Grange Road, into secondary technical school; A. G. Sinclair, borough architect.